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City of Batavia Broadband Study

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1. Executive Summary

The City of Batavia, Illinois' municipal electric utility seeks to explore how it may be able to use its expertise in fiber optics construction and operations to support the growth and success of local businesses that depend on reliable power for the success of their own operations.

This Report was researched and prepared in the latter part of 2011 and early 2012 by CTC Technology and Energy (CTC). It presents a brief feasibility analysis of the utility's proposed strategy.

Based on our research, analysis, and experience, CTC concludes that the utility's broadband pilot project would be a prudent way to:

1. test the feasibility of using existing infrastructure and staff resources to serve business customers in need of more sophisticated services than are currently available
2. support the City's economic development efforts
3. demonstrate to other communications providers that a business case exists for investing in Batavia and delivering next generation services to Batavia's commercial and industrial sectors
4. open up competitive markets for high bandwidth services to businesses where no such market currently exists

1.1 Project Background

The utility seeks to launch a pilot project to sell business-class broadband connectivity services to local businesses over the utility's current fiber optic infrastructure. The project would be launched and operated by existing utility staff and would be structured to limit the City's financial exposure.

The utility would create a communications enterprise that would lease poles and other facilities from the utility under the same terms as would any other enterprise. The same rules and requirements would be applied to the utility's own communications efforts as to any competing initiative. In this way, the utility can not only demonstrate the viability of providing new, better connectivity to the business community—but can also demonstrate that this goal can be achieved under existing processes and fairly-applied fees for access.

The utility has long suspected that there are gaps where the private market is not sufficiently meeting the commercial and business sectors' growing, sophisticated bandwidth needs. In the market for high-capacity broadband, there is little competition and extremely high pricing. The utility has the capability to provide those services, and thereby to open up a competitive market where none currently exists, likely incenting private carriers to improve both services and pricing, to the benefit of all Batavia businesses.

To these ends, the utility designed a small pilot to test whether this is a workable and feasible model. More than just testing the market, though, the pilot will, in a very modest way, result in important experience and data, and enable knowledgeable decision-making going forward.

As the utility conceives its pilot project, it would:

- Install headend equipment and fiber to customer premises
- Provide point-to-point service for commercial/industrial customers with multiple facilities
- Provide last-mile Internet services to commercial/industrial customers
- Offer speeds of 10 Mbps, 100 Mbps, and 1 Gbps (Gigabit Ethernet)

Longer term (and assuming that the pilot is successful), the utility hopes to achieve additional goals, including:

- Connecting cellular provider equipment
- Providing redundant physical connections to external fiber networks
- Attracting third-party carriers to serve future data center growth
- Increasing service levels to governmental entities already served
- Provide speeds of 10 Gbps or greater

In the late summer of 2011, the City engaged CTC to prepare this analysis. The focus of the engagement was to provide recommendations and insights that would help the utility to evaluate the feasibility of its pilot project and prepare to take the next steps toward implementing that network.

Over the course of the engagement, CTC performed the following general tasks:

1. Conducted a high-level technical review of relevant project documents, including maps of the citywide fiber system; details on existing feeds, splices, and equipment locations; specifications for network equipment; and narrative overview of the City's proposed pilot project.

2. Researched and evaluated the current *demand* for broadband communications products and services among small businesses in the City through a statistically valid mail survey.

3. Researched and evaluated the current *supply* of broadband communications products and services in the City through an assessment of available products and services in the Batavia market.

4. Vetted the utility's proposed costs for the pilot and added additional costs to ensure that all obligations were anticipated in advance.

5. Reviewed City costs and options for commodity Internet bandwidth that would be required to resell to the customers in the pilot project.

6. Developed financial statements, including assumptions around capital costs and staffing needs, for the pilot project.

1.2 Summary of Market Analysis

Our assessments of both the supply and demand sides of the market indicate that the City's modest goal for its pilot project's customer base—24 businesses—is feasible, because the data reflect an unmet need for reliable high-speed connectivity. Based on the results of the market research, we believe the utility can be reasonably confident that it will reach the pilot goal of serving 24 customers, assuming adequate marketing efforts and sales support.

On the supply side (based on our market assessment), we conclude that while a somewhat-adequate market exists for consumer-grade broadband services on the lower end of the pricing schedule (such as DSL, T1, and basic cable modem service), there are few options—and none at affordable prices—for higher-end services that include symmetrical bandwidth, guaranteed data rates, or high speeds. Batavia has an opportunity, through this fiber pilot, not only to satisfy this unsatisfied business need but also to dramatically impact pricing and availability for services at this important end of the market.

On the demand side (based on the survey results), we note that although the majority of respondents (70 percent) indicated that their Internet service is fast enough to meet their current needs, more than half of the respondents also indicated that they would be somewhat willing to pay 20 percent more for Internet service that allowed them to more quickly and efficiently perform key activities. About 40 percent of respondents would be willing to pay as much as 40 percent more for faster service. Respondents noted, too, that their top two uses of the Internet are online data storage and large data/file transfers—activities that would clearly benefit from higher-speed connectivity. These activities also rated among respondents' most important uses of their broadband connections.

In addition, it appears from the survey data that many Batavia businesses are somewhat dissatisfied with their current broadband services. Respondents felt that service reliability and download speeds are the most important aspects of their service purchase decision—yet they are not fully satisfied with the performance of their current service provider in either regard. This fairly sizeable gap suggests demand for the City's pilot project. (It is also, it bears noting, atypical; price usually has a large gap, while other aspects of service have much smaller gaps.)

CTC's analysis of the existing market for services is summarized in Section 2 below. The results of the survey are described and analyzed in detail in Section 5 below.

1.3 Summary of Financial Analysis

The survey results indicate that the City will likely find a core group of willing customers among the most sophisticated business users, and potentially also among smaller businesses that recognize the value of reliable high-speed connectivity.

Based on our analysis of the utility's technical plans, the City would need to make an upfront capital investment of $500,000—which, for purposes of the model, we have assumed will be a loan at 6 percent interest, to be paid over seven years, and with payments starting in year two.

Using our conservative base case assumptions for both costs and revenues, the pilot would cash

flow over a five- to seven-year period—meaning that it will (1) cover its own operating expenses, (2) fund a reserve account for equipment replacement at the end of five to seven years (so that the City has no further capital costs associated with the pilot), and (3) result in modest net earnings and a modest unrestricted cash balance of approximately $110,000 at the end of seven years—all of which can be used to reinvest in the network and expand offerings.

For purposes of the pilot project, we recommend that the utility offer a range of service levels—including 10 Mbps, 100 Mbps, 1 Gbps, and point-to-point connectivity—and service commitment durations ranging from month-to-month to three years. Customers who commit to longer service contracts would receive lower pricing (a model that will be familiar to potential customers). On a per site, per month basis, prices would be in the following ranges:

Service	Monthly Cost
10 Mbps	$550 to $1,373
100 Mbps	$1,100 to $2,746
1 Gbps	$1,900 to $4,742
Point-to-Point	$600 to $1,498

This pricing is highly competitive with any service available in the Batavia market.. The pilot project will not only make available cost-effective high-capacity services where none have existed before, but will also likely spur the creation of a competitive market as carriers react to the new services.

We have made conservative assumptions regarding the number of customers the utility will serve with each of these services. We believe it is likely that the utility's customers will include the larger and more sophisticated businesses in the commercial/industrial sector. For many smaller businesses, the value of symmetrical and guaranteed speeds is not apparent, even where pricing is competitive with the highly inferior asymmetrical "up to" speeds offered by the cable company. (For example, Comcast currently offers a cable modem product of "up to" 12 Mbps downstream and 2 Mbps upstream for $59.95. Actual speeds with this product may be a small fraction of the numbers quoted, particularly during busy times of the day, because cable modem service is shared—so any one consumer's capacity will be limited by its neighbor's capacity demands at that time.) Businesses that do not require or understand the value of higher capacity services are thus less likely to be initial pilot customers.

To the extent that the utility seeks to serve this wider range of customers, there is an important marketing effort necessary to demonstrate the benefit of symmetrical-speed connections relative to typical asymmetrical "up to" speeds promised by business-class service providers. The utility's challenge will be to demonstrate to some of its potential customers that the Comcast package is not comparable to that offered by the utility.

The results of the financial analysis are described and analyzed in detail in Section 4 below. A full pro forma is included as Appendix A.

1.4 Summary of Technical Analysis

CTC's Director of Engineering reviewed the utility's plans for the pilot and finds the technical planning to be sound and prudent.

As the City considers the competitive landscape for its pilot project, we note that it will be critical to maintain network uptime to remain competitive with existing carriers. Even if the City offers competitive services at the outset, the incumbents are capable of quickly upgrading their infrastructure and cutting business-facing prices. Maintaining a documented high availability rate—and the accompanying customer goodwill—will be extremely important.

The City's ring infrastructure and plans to increase the fiber quantity will help maintain that uptime. As the network grows, it will be advantageous to create a backbone ring. In the outside plant, one strategy might be provisioning a second physical path to each site around the ring with spare capacity; even if there is no optical failover in the equipment, the ability to quickly bypass a breakpoint in the backbone, if possible, by provisioning a second pair of fibers to each site in "cold" standby will make it possible to meet a high availability rate throughout the network. At the moment there appears to be sufficient fiber capacity to make that possible, as long as the number of customers remains low—and this will be a superior use of the fiber as compared to having it sit un-spliced, or as unspecified "spare" fiber. This will require no change in the City's estimated costs or plans.

We do note that scaling the pilot to a larger deployment will also require a different sort of equipment investment. As specified by the City's technical staff, the network equipment for the pilot is not carrier-grade equipment, but is better suited to an enterprise deployment. Thus, for example, there will be more limited ability to provide Service Level Agreements (SLA) relative to carrier equipment.

This equipment is entirely suited to the pilot and is appropriately cost-effective for the pilot, but if the network scales beyond the initial pilot customers, more sophisticated equipment will be necessary, including an upgrade to the level of electronics and use of multiple sites as hubs/headends. There will also need to be upgrade of platforms for management, billing, monitoring, and provisioning.

For purposes of the pilot program, we believe that existing hub space facilities are sufficient, and we have assumed colocation fees to use those facilities of approximately $1,000 per month. In the event that the pilot is scaled to a larger deployment, we anticipate that the utility will require more space, optimized for a communications enterprise. The utility has preliminary plans to build an optical node and collocation space within Batavia that could serve not only the utility but also other, competing providers—thus further enhancing both services and competition within Batavia. This strategy will align well with the need to scale to larger facilities if the pilot proves successful and is expanded. The modest net income projected here would be well suited to support the effort to develop the optical node.

The results of the technical analysis are described and analyzed in detail in Section 3 below.

1.5 A Further Note on Project Feasibility

The scope of this project is to assess the financial viability of the proposed pilot and, as described herein, we believe that pilot to be very viable. We note, however, that the types of analysis we conducted do not quantify or truly evaluate the benefits that will accrue to Batavia "beyond the financial statements"—the types of significant economic and community development benefits that are the true purpose for this type of project but generally do not accrue to the enterprise. Among these benefits are, potentially:

1. Enhanced productivity and operations for Batavia businesses that cannot currently buy high-end services at reasonable prices

2. Enhanced attractiveness of Batavia as a location for businesses that recognize the value of high-end connectivity

3. Faster, better migration to 4G mobile services by providers that will have access to the utility's fiber as they deploy the next generation of wireless, as well as potential deployment by competing providers that would not otherwise be able to afford to access the Batavia market

4. Increased investment and lower pricing by existing wireline providers who, for the first time, will face competition for the lower-end services from cost-effective high-end services

Each of these areas of potential benefit will deliver exponentially more value to the larger community in Batavia than the cost and revenue projections provided below can ever reflect. We respectfully suggest that these considerations should be part of the City's metrics for the success of the pilot.

The fourth area of potential benefit should, in particular, be considered a sign of dramatic success for the pilot should it materialize (as we anticipate it will): public infrastructure investment is frequently the spur to private sector innovation, investment, and competition. This benefit—the emergence of a true market for higher-end services—can, ironically, also mean that the pilot itself will be more challenging financially. Once the incumbents adjust to the utility's pricing and service offerings, the utility will be competing in a true market and financial metrics will be harder to achieve. That said, challenges on the financial side should be interpreted in light of the benefits that flow from opening up competitive markets and services where none would exist absent this public effort.

2. Current Supply of Broadband Services: Market Assessment

CTC performed a market assessment to determine a representative sampling of the providers selling broadband services to businesses in the City, the services being offered, and the pricing for various levels of service.

Our research focused on prominent service providers capable of offering Internet data access, metropolitan area Ethernet, frame relay and private point-to-point high-capacity circuits, as well as other important business services such as Web hosting, co-location, cloud services, and e-mail. To the extent possible, we gathered pricing and bundling information for each service type.

We collected data through Web research and telephone calls to providers' sales representatives. When asked, we identified ourselves as consultants working for the City; predictably, some of the companies we contacted were unwilling to provide pricing information because we were not a potential customer.

In brief summary, we learned that while an adequate market exists for consumer-grade broadband services on the lower end of the pricing schedule (such as DSL, T1, and basic cable modem service), there are few options—and none at affordable prices—for higher-end services that include symmetrical bandwidth, guaranteed data rates, or high speed. Batavia has an opportunity, through this fiber pilot, not only to satisfy this unsatisfied business need but also to dramatically impact pricing and availability for services at this end of the market.

The tables below identify a range of current broadband service providers, including:

- The services currently offered
- The costs for current services

2.1 Available Services and Pricing

This Section provides a brief overview of the existing wireline broadband landscape in Batavia. Based on research conducted on the Internet and over the telephone, small businesses and businesses with limited broadband needs have a range of connectivity options, including DSL, T1 circuits, and cable modem services. However, for medium to large businesses or smaller businesses with greater broadband demands, the fiber optic services that are necessary to support such demand appear to be scarcer and are only made available at much higher prices.

AT&T is Batavia's legacy phone company, and offers T1 services and DSL to most residents. DSL for businesses is not uniformly available, and the performance of the service varies depending on the distance of the business from AT&T's central office (CO) and the state of the copper plant between the business and the CO. Comcast offers cable modem service throughout most of the City, including non-residential neighborhoods. Cable modem service provides relatively uniform service throughout the service area, although not always to low-density business areas such as industrial parks. MegaPath (formerly Speakeasy) offers copper cable and T1 technologies, typically by reselling services over the phone company's plant and thus inherently incorporating some of the technical limitations described above.

The following tables illustrate the wireline broadband service options for a sample small business in Batavia. Unless otherwise stated each price represents the monthly service cost. Connection speed represents the advertised maximum ("up to") download speed; actual download speeds will vary, and actual upload speeds will be slower for each service listed.

Many providers offer additional services (other than Internet access) at reduced rates when "bundled" together. These services include data backup, Web hosting, phone and VoIP plans, and mobile services. Where Internet rates vary significantly when purchased as part of a bundle, the reduced price is listed in addition to the standalone price in the chart below. However, because providers offer so many permutations of service bundles, we have listed just a representative sampling. Actual monthly rates paid will vary widely depending on the number of computers at a business location and the ancillary services purchased.

We researched the availability of service for a small business in a central location in Batavia. When a specific address was needed, we used 160 S. Water St., Batavia, IL, 60510. This location is in the geographic heart of the City, and is close to many businesses and business parks. It is within approximately five miles from all parts of the City.

Table 1: Available Small Business Wireline Services

Provider	Wireline Service Type	Service Packages[1]	Additional Services Offered
AT&T	DSL[2]	Up to 6 Mbps/768 Kbps, pricing starts at $40 Speeds vary depending on the distance from the CO and age of the copper plant. Pricing includes one dynamic IP address; pricing increases $45 for 5 static IPs[3] One-year term	**Basic** – Local and long-distance phone with Internet, $75+ **Standard Choice 1** – Basic plus remote data backup and website design/hosting, $89+ **Standard Choice 2** – Basic plus 24/7 remote technical support, $89+ **Premium –** Standard Choice 2 plus remote data backup, web design/hosting, messaging (pricing starts at $114)

[1] Speeds are listed as download/upload. Prices are per month unless otherwise specified.
[2] Actual speed depends on the condition and availability of copper wires to the customer premises and its distance from the AT&T central office or remote cabinet.
[3] Source: http://www.att.com/gen/general?pid=9320&wtLinkLoc=S1 (accessed April 3, 2012)

Provider	Wireline Service Type	Service Packages[1]	Additional Services Offered
Comcast	Cable Modem Service	Starter: 12 Mbps/2 Mbps, $59.95[4] Premium: 22 Mbps/5 Mbps, $99.95 Deluxe: 50 Mbps/10 Mbps, $185.95 Deluxe 100: 100 Mbps/10 Mbps, $369.95 These services include e-mail, website hosting, and Microsoft cloud services.	**Voice plus Internet** 12 Mbps/2 Mbps $99 22 Mbps/5 Mbps $159 TV service can be added to these packages for about $5 One-time installation charges range up to approximately $200, but are reduced with contracts lasting longer than one year. *In-Package Upgrades/Add-Ons:*[5] Additional mailboxes: $6.99 Web hosting: $19.95 (Business), $39.95 (Commerce), $79.95 (Professional) Static IP: $14.95 (1 IP address), $19.95 (5 IP addresses), $34.95 (13 IP addresses) Additional voice lines: $39.95 (includes voicemail) for lines 2 to 3, $24.95 for 4th line and up Fax line: $24.95 TV package upgrade: $39.95 (Information & Entertainment), $69.95 (Standard), $84.95 (Preferred)

[4] Source: http://business.comcast.com/smb/services/Internet (April 3, 2012)
[5] Source: http://business.comcast.com/smb/bundle_5 (April 4, 2012)

Provider	Wireline Service Type	Service Packages[1]	Additional Services Offered
MegaPath	T-carrier	T1: 1.5 Mbps, $300[6] Bonded T1: 3 Mbps, $554 Bonded T1: 4.5 Mbps, $800 Bonded T1: 6 Mbps, $1,000	Bundle T1 with VoIP: $269 plus $16.95 to $29 per seat[7] Bonded T1: Price negotiable on higher connection services when bundling, similar to T1 discount. (Example: Cost would be reduced to approximately $500 for 3 Mbps Bonded T1, plus charges for VoIP seats.)
	Cable	22 Mbps /5 Mbps, $229 50 Mbps /10 Mbps, $379	

As CTC has seen in most markets, small business Internet connection options are limited to only a handful of providers. Batavia does have cable modem service available to small businesses, which provides relatively high Internet bandwidth capacity (compared to DSL) at relatively low pricing. The availability of two last-mile providers that serve small businesses makes the market more competitive than other similar markets where only DSL or higher-cost copper circuits such as T1s are available to small businesses.

Using the same address, we explored the availability of higher-end Internet connectivity services in the community. With the exception of some higher-end cable modem services, these services require fiber optic connectivity to the business. Unlike copper-based DSL and cable modem, where the last-mile providers are already located on-premises, fiber optic services usually require substantial fiber optic construction to reach the customer, which significantly affects the cost of service.

The following table summarizes the costs we were able to determine for high-end fiber optic services in Batavia. The table below does not include the cost of fiber construction, which the provider will usually only quote based on a potential order.

[6] Estimates gathered via discussion with provider representative. Prices are approximations.
[7] Representative indicated prices are negotiable when bundling services.

Table 2: Available Higher-End Services

Provider	Wireline Service Type	Service Packages[8]	Additional Services Offered
XO Communications	Fiber Dedicated Internet Access (DIA)[9]	Metro Ethernet: FastE (100 Mbps), GigE (1 Gbps), 10 Gbps, and 40 Gbps Sample price points:[10] 10 Mbps/10 Mbps $1,821 20 Mbps/20 Mbps $3,065 (Prices include $40 router fee)	VoIP [11] WAN Connectivity (Ethernet, MPLS IP-VPN, Private Line, VPLS, Wavelength) Managed/Hosted Services (Backup, Colocation, Hosted IT, Managed Security)
Comcast	DIA	Metro Ethernet: Typically 100 Mbps to 1,000 Mbps over fiber optics; lower services are provided using cable modem service Sample price points: Up to 100 Mbps/100 Mbps $3,000	VoIP [12] WAN Connectivity (Ethernet, MPLS IP-VPN, Private Line, VPLS, Wavelength) Managed/Hosted Services (Backup, Colocation, Hosted IT, Managed Security)
NIUnet [13]	Fiber Internet	10 Mbps $15 per Mb; $750 one-time cost 50 Mbps $12 per Mb; $750 one-time cost 100 Mbps $10 per Mb; $750 one-time cost 1 Gbps $8 per Mb; $1,500 one-time cost	Virtual Firewall: $75 plus $250 one-time cost IT development and helpdesk services quoted case by case NIUnet services are not available to the general public—they are sold to municipalities, educational entities, and the health care sector

[8] Speeds are listed as download/upload. Prices are per month unless otherwise specified.
[9] With a Dedicated Internet Connection, speeds listed are guaranteed, unlike other commercial connections where speeds listed are maximums, and depend on other usage amounts.
[10] Estimates gathered via discussion with provider representative. Prices are approximations.
[11] Source: http://www.xo.com/forms/Campaign/ExternalSales/contact/free_consultation.aspx (April 4, 2012)
[12] Source: http://www.xo.com/forms/Campaign/ExternalSales/contact/free_consultation.aspx (April 4, 2012)
[13] Northern Illinois University's fiber network offers both commodity Internet and co-location services to schools and institutes in the region. It also offers service to the health care industry, including hospitals.

Provider	Wireline Service Type	Service Packages[8]	Additional Services Offered
Level 3	Fiber Internet	DIA TDM (DS1-OC48) or Ethernet Speeds (FastE (100 Mbps), GigE (1 Gbps), 10GigE (10 Gbps)) Flat rate, usage-based, and aggregate billing options Costs unavailable	WAN Connectivity (Ethernet, MPLS IP-VPN, Private Line, VPLS, Wavelength) Managed/Hosted Services (Backup, Colocation, Hosted IT, Managed Security)

High-capacity broadband circuit pricing varies greatly depending on the proximity of a business to the provider's existing fiber optic plant. In order to recoup their fiber optic construction costs, providers will often either charge a high non-recurring fee at the purchase of a service or spread the cost out over the length of the contract for a service. This cost recuperation often requires that businesses sign a long-term (three- to five-year) contract. There is also a large amount of outside plant engineering required to generate accurate cost estimates. Therefore, telecommunications providers often do not provide cost estimates for these types of services.

From the costs estimates we were able to obtain it is clear that high-capacity broadband circuits over fiber optics cost considerably more than the small business offerings. The higher costs are based on both the actual cost to build and operate theses circuits as well as market forces: Businesses that require these types of circuits will pay a premium for such services.

The above data is aggregated in the following table for easier reference. (We have not included the NIUnet pricing as it is not available to most business consumers.)

Table 3: Summary of Available Services

Internet Speed	Estimated Monthly Recurring Cost
768 Kbps – 6 Mbps (Download) / 384 Kbps – 768 Kbps (Upload)	$40 per month
1.5 Mbps (Dedicated and Symmetrical)	$300 per month
3 Mbps (Dedicated and Symmetrical)	$554 per month
4.5 Mbps (Dedicated and Symmetrical)	$800 per month
6 Mbps (Dedicated and Symmetrical)	$1,000 per month
22 Mbps (Download)/5 Mbps (Upload)	$229 per month
50 Mbps (Download)/10 Mbps (Upload)	$379 per month
10 Mbps (Dedicated and Symmetrical)	$1,821 per month
20 Mbps (Dedicated and Symmetrical)	$3,065 per month

2.2 City Costs and Options for Internet Access

A key element of the City's pilot project is the availability of cost-effective commodity Internet bandwidth that the City can resell as a service to pilot participants. Accordingly, CTC identified a range of potential providers of Internet access for the City and, on Batavia's behalf, attempted to obtain pricing for wholesale capacity.

Commodity Internet bandwidth is available in Batavia from a number of sources. Service providers that offer wholesale Ethernet services in Batavia include AT&T, Cogent Communications, Comcast, MegaPath, and Northern Illinois University (NIUnet). The following table summarizes the Ethernet services available. (Other services, such as SONET, may also be available from these providers; we have omitted information we consider not to be relevant to the City's public network planning.)

Because these services require infrastructure to be built out to the purchaser of the service, we cannot guarantee that any service is available at any given location. Availability and price of proprietary networks are known to fluctuate at a very granular level, even within a city block. Nor will wholesale providers usually provide specific prices for these services without specific details of the business customer's location, service requirements, and plant installation specifications. We contacted providers as representatives of the City to obtain these data, and while we were often able to get information about the types of services offered, providers were generally unwilling or unable to provide pricing estimates.

Table 4: Summary of Available Wholesale Services

Wholesale Provider	Wholesale Ethernet Service Type	Speed	Costs
AT&T	Commodity Internet Bandwidth	100 Mbps 1 Gbps 10 Gbps	Declined to provide
Comcast	Commodity Internet Bandwidth	100 Mbps 1 Gbps	Declined to provide, though we believe 100 Mbps service is available to select customers for $3,000 per month
Cogent Communications	Commodity Internet Bandwidth	1 Gbps	$5,500 per month (month-to-month), $4,500 per month (12-, 24-, or 36-month contract)
MegaPath	Ethernet over copper	100 Mbps to 1 Gbps	Declined to provide
NIUnet	Commodity Internet Bandwidth	10 Mbps 100 Mbps 1 Gbps	$150 per month $1, 000 per month $8,000 per month

The Cogent Communications commodity Internet bandwidth cost includes transport costs from Batavia to Cogent's datacenter in Chicago. This would require Batavia to purchase a separate transport circuit from another provider such as NIUnet or one of the dark fiber providers in the area. The NIUnet commodity bandwidth service does not require additional transport services because NIUnet peers with the City.

Though we have few data points for pricing in Batavia, our research in other jurisdictions engaged in similar pursuits are valuable points of comparison. In a market analysis of the wholesale broadband market in North Kansas City, Mo., we found a price range of $400 to $7,000 per month for Ethernet speeds ranging from 10 Mbps to 1 Gbps. North Kansas City has relatively low commodity bandwidth costs because of their existing collocation space within a major Internet point of presence (POP) within the City, which eliminates transport costs and offers the City more competitive options for commodity bandwidth. In a similar analysis in Ocala, Fla., we estimated a price range of $3,200 to $13,700 per month for speeds ranging from 100 Mbps to 1 Gbps. Ocala is located in a more rural area of Florida and is subject to less competition and increased transport costs.

The costs of Cogent and NIUnet wholesale data transport services in Batavia fall in between those of North Kansas City and Ocala, as shown in Table 5.

Table 5: Comparison of Speeds and Prices with North Kansas City, Mo. and Ocala, Fla.

City	Speed Range	Pricing Low	Pricing High
Batavia	**100 Mbps – 1 Gbps**	**$1,000**	**$8,000**
North Kansas City	100 Mbps – 1 Gbps	$400	$7,000
Ocala	100 Mbps – 1 Gbps	$3,200	13,700

Based on these findings, we have used the NIUnet price of $8 per Mbps per month in our technical and financial projections (Sections 3 and 4 below). The inclusion of transport fees and the existing collocation between the City and NIUnet makes the commodity Internet bandwidth service a logical choice for the pilot program.

3. Technical Analysis and Overview of Pilot Project Costs

CTC reviewed the City's network diagrams, plans, maps, and architecture documents, as well as its preliminary cost estimates. We also interviewed City staff about current operations and future plans. Per the City's instructions, we focused on a scenario of approximately 24 customers for the pilot project. Based on our experience with hundreds of fiber networks, we find the utility's preliminary plans to be sound and well-considered.

3.1 Outside Plant Costs

The cost of physical plant construction depends on the location of the customer relative to the plant (both the distance from the fiber and the available quantity of fiber in the cable); whether or not the customer is in an aerial or underground utilities area; and the infrastructure between the street and the facility (e.g., grass, parking lot, concrete, existing conduit). Therefore, any estimate at the level of generality represented by the project maps will be extremely approximate.

Based on CTC's experience in construction to institutional facilities (such as businesses and government buildings) we believe the City's cost estimate of $19 to $24 per foot[14] is generous, and that many installations will be less costly. Electrical utilities are well-equipped to find cost-effective building entry. The cost can be further reduced if customers are clustered and the construction can be coordinated.

We assume a need for construction of 4.54 miles of new fiber optic plant to attach the new sites to be served in the pilot, assuming an average of 1,000 feet per new site (this is in addition to leasing access to the utility's existing fiber plant). Further, assuming that utility poles exist approximately every 150 feet, there will be 35 poles per mile of aerial fiber plant. Assuming construction will be evenly divided among aerial and underground plant, there will be a need for 17.5 poles per mile—an approximate total of 80 poles, with an associated attachment fee for each of $30.

Based on the data provided by the City, we estimate outside plant construction costs in the range of $480,000 for the pilot; in addition, we project ongoing attachment fees of $1,200 per year, colocation/hub fees of $12,000 per year, and fiber leasing fees of $51,600 per year.

3.2 Equipment Costs

We obtained approximate prices for the electronics and equipment that the City would need to implement its preliminary design, and found that the City's preliminary cost estimates for that equipment are reasonable. Our detailed cost estimates are listed in the tables below.

Table 6: Pilot Project Headend Equipment Costs

[14] The City estimates installation to customer premises, including directional bore with 2-inch poly-pipe, pull box(es), interior patch panel, splices, and all labor as follows: 500′, $12,000; 1,000′, $20,000; and 2,000′, $38,000.

Initial Headend Equipment	QTY	Unit Price	Subtotal
Cisco 3750E	2	$10,000	$20,000
Cisco RPS 2300	1	$800	$800
Cisco Power Supplies	4	$600	$2,400
Transitions Network ION Chassis	1	$1,000	$1,000
TN AC Power Supply	1	$600	$600
TN ION Management Module	1	$200	$200
Cisco ASA 5525X	1	$7,000	$7,000
Admin/Network Management Server	1	$5,000	$5,000
		Total	***$37,000***

Table 7: Pilot Project Additional Required Core Equipment Costs

Equipment Needed for Every 19th Customer	QTY	Unit Price	Subtotal
Transitions Network ION Chassis	1	$1,000	$1,000
TN AC Power Supply	1	$600	$600
TN ION Management Module	1	$200	$200
		Total:	***$1,800***

Table 8: Pilot Project Customer Premises Equipment Costs

Equipment Needed Per Customer	QTY	Unit Price	Subtotal
1310 nm SFPs	2	$300	$600
10/100/1000 to SFP Media Converter at Headend	1	$600	$600
SFP to 10/100/1000 Media Converter at CP	1	$650	$650
		Total	***$1,850***

3.3 Fiber Management Software

We note that it is optimal to automate fiber management before fiber or services are offered to outside customers (or, if not that early, at least when the number of connected locations is fewer than, say, 20). Fiber management software would enable the City to:

- Centralize the fiber assignment
- More effectively plan fiber use
- Plan complex connections for redundant services
- Allow service connection to happen more quickly, and
- Make strategic decisions about fiber backbone construction.

For a pilot network of this size, we recommend $15,000 be earmarked for fiber documentation software, including a dedicated computer workstation and staff training.

4. Financial Analysis of Pilot Project

The pro forma financial analysis we prepared for the pilot program is designed to assist the City in deciding whether to proceed with implementation—and to understand the impact that various cost and revenue assumptions will have on the financial outcome.

Our base case analysis is presented below. The pro forma, which is described in Section 4.2 and attached in full as Appendix A, incorporates anticipated revenues, operating expenses, and capital expenditures developed as part of this study. We present a variety of sensitivity analyses in Section 4.3.

4.1 Description of Base Case Assumptions

Our "base case" for the pilot network assumes that the City would contribute $500,000 to launch the pilot. This cash infusion would cover the necessary capital costs and initial operating expenses. We assume that the utility will finance this contribution at 6 percent over seven years, with repayment beginning in the second year.

Under our base case scenario, the network would have a positive unrestricted cash balance by the end of year two.

Table 9: Base Case Financial Projection

	Year						
	1	**2**	**3**	**4**	**5**	**6**	**7**
Net Income	17,301	82,301	86,600	91,161	95,993	101,116	106,545
Net Cash from Operations	(24,310)	22,809	22,807	22,809	22,809	22,809	22,807
Year-End Unrestricted Cash Balance	(24,310)	(1,501)	21,306	44,115	66,924	89,733	112,540

The network would serve 24 customers,. The model assumes that most of the customers would begin service almost immediately after the network launches—and that all of them would be connected by the end of year one. Rather than a more gradual ramp-up, as would be typical with a new network, revenue recognition is estimated at 85 percent in the first year and 100 percent in all subsequent years. (The number of customers and the speed of acquisition are based on the utility's projections for the pilot; the survey results validate both.)

We have assumed that the utility will sell its customers a variety of services at a range of monthly fees and service commitment periods. Our recommendations for fee levels and our assumptions regarding take rate are illustrated in Table 10. The fees are based on what we believe the market will support.

Table 10: Pilot Project–Services

Service	Number of Customers	Monthly Fee per Site[15]
10 Mbps	8	$550 to $1,373
100 Mbps	6	$1,100 to $1,716
1 Gbps	6	$1,900 to $2,964
Point-to-Point	4	$600 to $936

The model assumes that all customers would take a one- to three-year contract. Under these assumptions, revenue would plateau at $371,000 annually, starting in year two.

This scenario involves a range of factors, all of which we have estimated conservatively. That said, any financial projection is subject to the vagaries of actual business events; accordingly, it is important to evaluate each of the assumptions and make adjustments as market conditions or actual results require.

4.1.1 Network Equipment and Fiber

The pilot project would require about $571,000 in capital additions, including fiber, headend and hub equipment, and end user or customer premises equipment (CPE). Fiber represents the bulk of this projected cost, at $480,000 (depreciable over 20 years).

CPE would cost $1,850 per site. Under our recommended model, only month-to-month customers would pay this cost at the time of installation, to ensure that the City does not have to absorb that cost if the customer drops the service after only a short period of time. This also reflects a belief that some customers who are willing to sign a longer-term contract would balk at paying a large upfront cost as a prerequisite for buying services on an unproven network. It might also incent some customers who would otherwise opt for month-to-month service to commit to a longer-term contract. If sales are going well, this model also gives the City some flexibility to increase its revenues by recapturing some of the CPE costs; it could, for example, require customers that choose a one-year contract to pay a portion of the CPE cost (say, 25 percent). In other words, the City would have some flexibility, based on sales, to increase revenues.

Following best practices for network infrastructure, the City would fund a depreciation operating reserve to cover the cost of replacement equipment. Headend and hub equipment would be replaced after seven years; access site electronics and CPE, which have a shorter lifecycle, would be replaced after five years. The annual contribution would be equivalent to 70 percent of depreciation of the initial capital cost, beginning in year 2, based on our expectation that equipment costs will decline modestly over time.

[15] These prices represent a range based on service commitment periods, with monthly prices declining as commitment periods increase; month-to-month customers will pay significantly higher rates than customers that commit to a three-year contract.

4.1.2 Operations

The project's Internet connection fee would be one of the largest expenses for the pilot; we estimate it at $64,000 annually, based on a cost of $8 per Mbps per month (current pricing available from NIUnet and, as far as our research revealed, the most cost-effective commodity pricing available to the utility at the current time[16]) and an oversubscription ratio of ten.[17]

Our projections further assume pole attachment fees of $1,200 and other costs to be paid to the utility, including $51,800 for fiber access on existing plant and $12,000 for colocation space. We estimate $1,500 in annual transportation costs and billing software at 3,000 per year. We also include costs for sales and marketing ($12,000 in year one, decreasing to $6,000 in subsequent years) and insurance (a level $25,000 annually).

Total non-labor operating expenses would be $111,800 in year one, and would dip slightly to about $105,300 in the following years.

4.1.3 Labor

Labor costs are a second large expense for the pilot. We estimate that the utility will need to add or allocate the equivalent of about 60 percent of a full-time-equivalent (FTE) staff member in year one, and about 45 percent throughout the remainder of the project, in addition to staff resources for holidays, weekends, and after-hours support (Table 11).[18] These staffing levels would cost about $57,000 in year one, and roughly $49,000 in the following years (fully burdened labor rates). Our revenue projections are sufficiently conservative that, should additional labor be required, we believe revenues could increase to cover this unanticipated cost.

Table 11: Pilot Project–Staffing

Staff Category	FTE Needed	Annual Cost
Internet technician/ Engineer	0.25	$22,500
Sales and marketing representative	0.10	$7,000
Installer	0.25 (year one); 0.10 (year two+)	$12,500 (year one); $5,000 (year two+)
On-call technician	n/a	$14,910

[16] Section 2 provides our assessment of pricing for commodity Internet bandwidth (and transport if necessary). NIUnet's pricing appears to be the most cost-effective in the current market (in part because there is no transport charge necessary), though we note that providers were extremely reluctant to share any information with us. The utility may wish to use an RFP process to determine whether even lower pricing is available in Batavia in light of recent years' dramatic decreases in commodity charges in metropolitan areas.

[17] Oversubscription refers to the ratio of the allocated bandwidth per user to the guaranteed bandwidth per user.

[18] These staffing levels are relatively low (though still entirely realistic) because we assume that the network's customers will not require a great deal of handholding; most of the business customers will be sophisticated users of broadband and network connectivity.

4.2 Overview of Network Financials

Under our base assumptions, the pilot network's annual revenue would exceed its operating expenses in year one. Even when depreciation expenses and financing costs are added, net operating income is positive in year one.

Table 12: Pilot Project–Base Case Income Statement

Year	1	2	3	4	5	6	7
a. Revenues							
Fiber Based Services	$ 320,000	$ 371,000	$ 371,000	$ 371,000	$ 371,000	$ 371,000	$ 371,000
Customer Connection Fees (non-recurring)	-	-	-	-	-	-	-
Total	$ 320,000	$ 371,000	$ 371,000	$ 371,000	$ 371,000	$ 371,000	$ 371,000
b. Operating Expenses - Cash (not including taxes in line h)							
Operating Expenses	176,600	170,100	170,100	170,100	170,100	170,100	170,100
Salaries	56,910	49,410	49,410	49,410	49,410	49,410	49,410
Total	$ 233,510	$ 219,510	$ 219,512	$ 219,510	$ 219,510	$ 219,510	$ 219,510
c. Revenues less Cash Operating Expenses (a-b)	$ 86,490	$ 151,490	$ 151,488	$ 151,490	$ 151,490	$ 151,490	$ 151,490
d. Operating Expenses - Non-Cash							
Depreciation	$ 39,189	$ 39,189	$ 39,189	$ 39,189	$ 39,189	$ 39,189	$ 39,189
e. Operating Income (d-c)	$ 47,301	$ 112,301	$ 112,299	$ 112,301	$ 112,301	$ 112,301	$ 112,301
f. Non-Operating Income							
Interest Income	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Investment Income	-	-	-	-	-	-	-
Interest Expense (Loan)	(30,000)	(30,000)	(25,699)	(21,140)	(16,308)	(11,185)	(5,756)
Total	$ (30,000)	$ (30,000)	$ (25,699)	$ (21,140)	$ (16,308)	$ (11,185)	$ (5,756)
g. Net Income	$ 17,301	$ 82,301	$ 86,600	$ 91,161	$ 95,993	$ 101,116	$ 106,545
h. Taxes (non-member services and dark fiber)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
i. Net Income After Fees & In Lieu Taxes	$ 17,301	$ 82,301	$ 86,600	$ 91,161	$ 95,993	$ 101,116	$ 106,545

Net operating income does not reflect actual cash flow, however, because depreciation is a non-cash expense and the income statement does not include actual network deployment costs or the depreciation reserve fund that the utility will use to replace the network equipment at the end of its five- or seven-year life expectancy.[19]

When other cash transactions are added, the network is in the red for the first year, by about $25,000, and then realizes a positive unrestricted cash balance of about $25,000 starting in year two.

[19] Network electronics have a life expectancy and must be replaced on schedule, or the network risks performance and reliability problems; a depreciation reserve fund would be like a household's "rainy day" account, which covers the cost of a new furnace when the current one breaks.

Table 13: Pilot Project–Base Case Cash Flow Statement

Year	1	2	3	4	5	6	7
a. Net Income (From Income Statement)	$ 17,301	$ 82,301	$ 86,600	$ 91,161	$ 95,993	$ 101,116	$ 106,545
b. Cash Outflows							
Debt Service Reserve	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Interest Reserve	-	-	-	-	-	-	-
Depreciation Operating Reserve	-	(27,000)	(27,000)	(27,000)	(27,000)	(27,000)	(27,000)
Financing	(10,000)	-	-	-	-	-	-
Capital Expenditures	(570,800)	-	-	-	-	(38,800)	-
Total	$ (580,800)	$ (27,000)	$ (27,000)	$ (27,000)	$ (27,000)	$ (65,800)	$ (27,000)
c. Cash Inflows							
Interest Reserve	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Depreciation Operating Reserve	-	-	-	-	-	38,800	-
Debt Service Reserve	-	-	-	-	-	-	-
Cash Start	-	-	-	-	-	-	-
Loan	500,000	-	-	-	-	-	-
Total	$ 500,000	$ -	$ -	$ -	$ -	$ 38,800	$ -
d. Total Cash Outflows and Inflows (b+c)	$ (80,800)	$ (27,000)	$ (27,000)	$ (27,000)	$ (27,000)	$ (27,000)	$ (27,000)
e. Non-Cash Expenses - Depreciation	$ 39,189	$ 39,189	$ 39,189	$ 39,189	$ 39,189	$ 39,189	$ 39,189
f. Adjustments							
Proceeds from Additional Cash Flows	$ (500,000)	$ -	$ -	$ -	$ -	$ -	$ -
Total	$ (500,000)	$ -	$ -	$ -	$ -	$ -	$ -
g. Adjusted Available Net Revenue	$ (524,310)	$ 94,490	$ 98,789	$ 103,350	$ 108,182	$ 113,305	$ 118,734
h. Principal Payments on Debt							
Loan Principal	$ -	$ 71,681	$ 75,982	$ 80,541	$ 85,373	$ 90,496	$ 95,927
Total	$ -	$ 71,681	$ 75,982	$ 80,541	$ 85,373	$ 90,496	$ 95,927
i. Net Cash	$ (24,310)	$ 22,809	$ 22,807	$ 22,809	$ 22,809	$ 22,809	$ 22,807
Cash Balance							
Unrestricted Cash Balance	$ (24,310)	$ (1,501)	$ 21,306	$ 44,115	$ 66,924	$ 89,733	$ 112,540
Depreciation Operating Reserve	-	27,000	54,000	81,000	108,000	96,200	123,200
Debt Service Reserve	-	-	-	-	-	-	-
Total Cash Balance	$ (24,310)	$ 25,499	$ 75,306	$ 125,115	$ 174,924	$ 185,933	$ 235,740
Debt Service Balance	$ 500,000	$ 428,319	$ 352,337	$ 271,796	$ 186,423	$ 95,927	$ -

4.3 Variations on Base Case

Our analysis highlights the critical assumptions that have the greatest impact or sensitivity to the financial model's projected outcome. We examined a variety of scenarios to identify the potential range of outcomes if those assumptions were to change.

Even at our low projected staffing requirements, the City's labor costs will have a large impact on the pilot project's financial success. If the cost of labor were reduced by 50 percent, for example, the network would end year seven with a cash balance of more than $280,000.[20]

Table 14: Pilot Project Financial Scenario: Labor Costs Reduced by 50 Percent

	1	2	3	4	5	6	7
Net Income	$ 45,756	$ 107,006	$ 111,305	$ 115,866	$ 120,698	$ 125,821	$ 131,250
Net Cash from Operations	$ 4,145	$ 47,514	$ 47,512	$ 47,514	$ 47,514	$ 47,514	$ 47,512
Year End Cash Balance	$ 4,145	$ 51,659	$ 99,171	$ 146,685	$ 194,199	$ 241,713	$ 289,225

On the other hand, if labor costs were to double, the pilot would have a roughly $240,000 deficit at the end of the same period—meaning that an ongoing financial subsidy would be necessary.

[20] All of the scenarios presented here assume that all other assumptions remain constant.

Table 15: Pilot Project Financial Scenario: Labor Costs Increased by 100 Percent

	Year						
	1	2	3	4	5	6	7
Net Income	$ (39,609)	$ 32,891	$ 37,190	$ 41,751	$ 46,583	$ 51,706	$ 57,135
Net Cash from Operations	$ (81,220)	$ (26,601)	$ (26,603)	$ (26,601)	$ (26,601)	$ (26,601)	$ (26,603)
Year End Cash Balance	$ (81,220)	$ (107,821)	$ (134,424)	$ (161,025)	$ (187,626)	$ (214,227)	$ (240,830)

Reducing projected network revenue would have the same effect as increasing costs. If the monthly fees paid by customers were lowered by just 10 percent over the base case assumptions, the network would have a deficit of more than $110,000 at the end of year seven.

Table 16: Pilot Project Financial Scenario: Service Fees Reduced by 10 Percent

	Year						
	1	2	3	4	5	6	7
Net Income	$ (11,599)	$ 49,301	$ 53,600	$ 58,161	$ 62,993	$ 68,116	$ 73,545
Net Cash from Operations	$ (53,210)	$ (10,191)	$ (10,193)	$ (10,191)	$ (10,191)	$ (10,191)	$ (10,193)
Year End Cash Balance	$ (53,210)	$ (63,401)	$ (73,594)	$ (83,785)	$ (93,976)	$ (104,167)	$ (114,360)

If market forces required the utility to reduce its monthly service charges by 25 percent, the effect on the network's cash balance would be even more stark: Batavia would need to provide a total subsidy of more than $450,000 through the end of year seven.

Table 17: Pilot Project Financial Scenario: Service Fees Reduced by 25 Percent

	Year						
	1	2	3	4	5	6	7
Net Income	$ (53,949)	$ (1,699)	$ 2,600	$ 7,161	$ 11,993	$ 17,116	$ 22,545
Net Cash from Operations	$ (95,560)	$ (61,191)	$ (61,193)	$ (61,191)	$ (61,191)	$ (61,191)	$ (61,193)
Year End Cash Balance	$ (95,560)	$ (156,751)	$ (217,944)	$ (279,135)	$ (340,326)	$ (401,517)	$ (462,710)

Under a more optimistic scenario, if the City were able to raise its service fees by 25 percent, it would have a projected cash balance of nearly $690,000 at the end of the seven-year period.

Table 18: Pilot Project Financial Scenario: Service Fees Increased by 25 Percent

	Year						
	1	2	3	4	5	6	7
Net Income	$ 88,551	$ 166,301	$ 170,600	$ 175,161	$ 179,993	$ 185,116	$ 190,545
Net Cash from Operations	$ 46,940	$ 106,809	$ 106,807	$ 106,809	$ 106,809	$ 106,809	$ 106,807
Year End Cash Balance	$ 46,940	$ 153,749	$ 260,556	$ 367,365	$ 474,174	$ 580,983	$ 687,790

Finally, if the utility is able to increase prices by just 10 percent, the year-seven cash balance would increase from the base case to about $345,000.

Table 19: Pilot Project Financial Scenario: Service Fees Increased by 10 percent

	Year						
	1	2	3	4	5	6	7
Net Income	$ 46,201	$ 116,301	$ 120,600	$ 125,161	$ 129,993	$ 135,116	$ 140,545
Net Cash from Operations	$ 4,590	$ 56,809	$ 56,807	$ 56,809	$ 56,809	$ 56,809	$ 56,807
Year End Cash Balance	$ 4,590	$ 61,399	$ 118,206	$ 175,015	$ 231,824	$ 288,633	$ 345,440

5. Current Demand for Broadband Services: Market Research

On the City's behalf, we conducted a survey of businesses in Batavia to determine customer satisfaction with current Internet service providers and the services offered. The survey aimed to collect data that would allow the City to understand both the potential unmet broadband needs in the business community and ways in which improved communications services could benefit the businesses.[21]

5.1 Survey Summary

We mailed a questionnaire to 300 randomly selected businesses in Batavia in September 2011. To encourage participation, the survey was printed as a booklet, which enhances the readability of the survey, and was enclosed in a non-standard-sized envelope to make it stand out. The survey was estimated to take 12 to 15 minutes to complete.

The survey was designed to obtain information about responding businesses' use and perception of communications services within the community. Key findings from the business communications survey include:

- 93 percent of responding businesses in Batavia have Internet access; of those, 20 percent connect multiple sites.
- Among businesses in Batavia that have Internet access, there is a fairly sizeable gap between those subscribers' sense of the importance of various aspects of their existing service, and their satisfaction with that service. This is atypical; price usually has a large gap, while other aspects of service have much smaller gaps.
- DSL is the primary Internet access types (57 percent of market share), followed by cable (23 percent) and leased line (13 percent).
- The majority of respondents (70 percent) indicated that their Internet service is fast enough to meet their needs. Another 28 percent said their service speed is marginal.
- Nearly nine in 10 (88 percent) of businesses with Internet service have a website, and 31 percent use it for e-commerce.
- Respondents' top two uses of the Internet are activities that would clearly benefit from higher-speed connectivity: online data storage and backup (41 percent) and large data/file transfers (39 percent). These were also rated among the most important uses. The applications receiving the lowest importance ratings were videoconferencing and Voice over IP (VoIP) telephony.

[21] CTC was responsible for all project communications, coordination, methodologies, and reporting of results. CTC also managed the work of contractors involved in survey printing, mailing, and processing. City staff provided feedback on the draft survey instrument, provided a customer database for survey recipient selection, and reviewed preliminary study findings.

- 60 percent of those with Internet access said they typically experience downtime less than once per month. More than one-half (54 percent) contacted their Internet service provider because of technical difficulties, billing, or other issues, with the majority (85 percent) saying their issue was resolved in a satisfactory manner.
- Respondents would be somewhat willing to pay 20 percent more for Internet service that allowed them to more quickly and efficiently perform key activities. The majority would be unwilling to pay an additional 40 percent or more. This shows little price "headroom," even for higher-speed or higher-quality service.
- Overall, respondents agree somewhat that Batavia should build a communications infrastructure to facilitate community access to very high speed Internet service at competitive prices. They would be somewhat willing to support a plan to build a communications network for private companies if it were operated with only subscriber revenue.

5.2 Background and Objectives

The business communications survey was designed to capture substantial information about businesses' use of, and satisfaction with, Internet and related communications services in Batavia. Businesses were asked about their:

- Computer and Internet use
- Use of other communications services
- Connectivity and reliability issues
- Satisfaction with and importance of Internet services
- Opinions about the availability and necessity of high-speed Internet service in the community, as well as the City's role in enabling or providing communications services
- General business information

This information was intended to help the City evaluate market needs and demand for communication services, and to identify ways in which the City might be able to help improve these services to area businesses.

5.2.1 Survey Mailing and Response

A total of 300 survey packets were mailed in September 2011 to businesses located in proximity to the City's existing fiber infrastructure; businesses identified by the City as necessary inclusions; and other, randomly selected businesses in. The surveys were mailed first-class and included a postage-paid envelope to return the completed forms to the survey processor for verification and data entry.

A total of 55 useable responses were received by the cut-off date, providing a response rate of 18.3 percent. This includes responses from four businesses within proximity of existing fiber, as well as five businesses that were non-randomly selected (i.e. included in the sample as part of the "must-send" subgroup).

With a randomly selected sample, the maximum margin of error based on a sample size of 55

and approximately 621 unique businesses[22] in the service area would be ±12.6 percent at the 95 percent probability level for aggregate responses. However, because the sample was, in part, non-randomly selected and the population of interest included a subgroup of business-types or industries in the area, the results may not statistically represent the larger population of all businesses in Batavia.

5.2.2 Data Analysis

Survey data was entered into SPSS[23] software where the data was coded, labeled, cleaned, and verified. Survey data was evaluated using techniques in SPSS including frequency tables, cross-tabulations, and means functions.

5.3 Survey Results

The business survey results are presented in the following sections. Survey results for most questions are presented in tabular and/or graphic format, accompanied by our analysis. Comparisons or cross-tabulations of responses based on business characteristics or services types are not discussed, given the relatively small number of responses for some subgroups.[24] It should be noted that statements referring to "Batavia" businesses refer only to respondents to the survey.

5.3.1 Computers and Internet Access

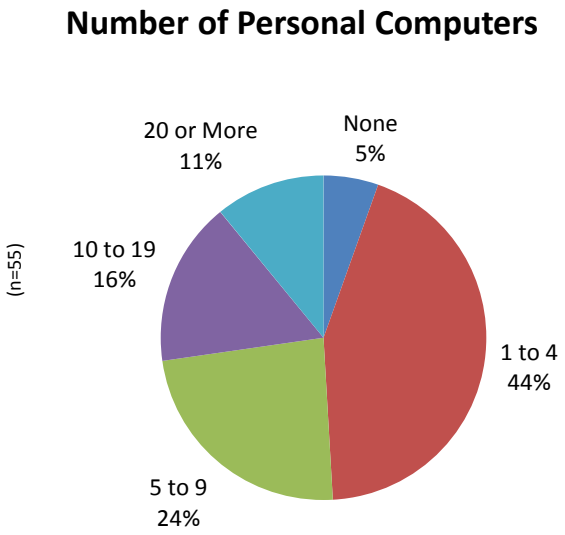
The survey included questions about computers, Internet service, and related technology to compare usage by types of service providers. This provides insights into how businesses use communication services.

Computers

Twenty-four of 55 (44 percent) responding businesses have one to four computers or terminals at the location surveyed. Another 13 of 55 (24 percent) have five to nine computers, and 15 of 55 (27 percent) have 10 or more computers. Just three of 55 (five percent) do not have any computers or terminals at that location.

[22] Total employer establishments from the 2007 U.S. Economic Census
[23] Statistical Package for the Social Scientist www.spss.com
[24] It is difficult to draw meaningful conclusions for subgroups that have very few responses. For example, just 11 respondents have cable modems, which makes it difficult to determine with a high degree of accuracy the average price of cable modem service.

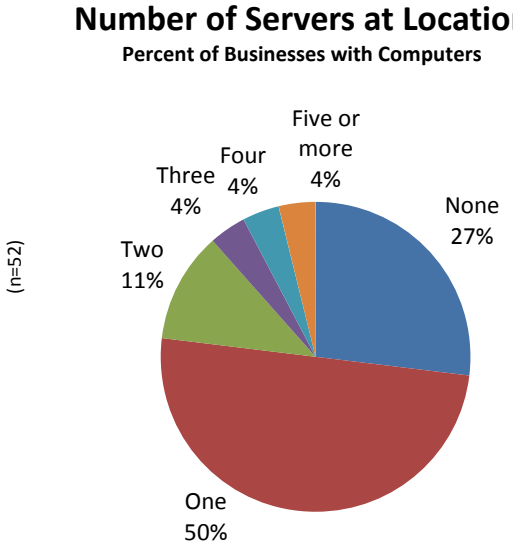
Figure 1: Survey Results – Number of Computers



Servers

Fourteen of 52 (27 percent) responding businesses with computers do not have a server at the location surveyed. Twenty-six of 52 (50 percent) have one, and 12 of 52 (23 percent) have more than one.

Figure 2: Survey Results – Number of Servers



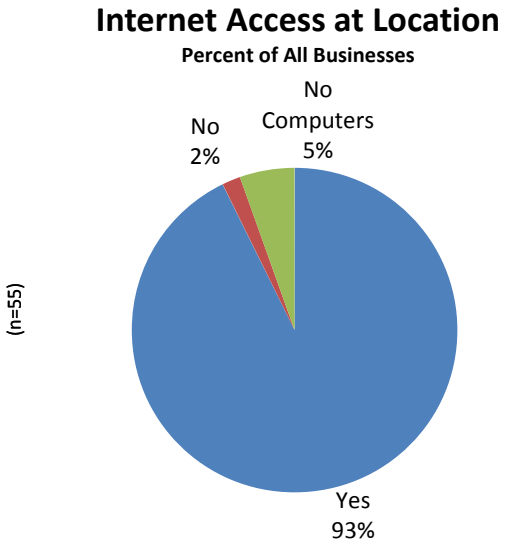
Internet Access

Fifty-one of 55 (93 percent) responding businesses have Internet service at that location. Another three of 55 (5 percent) do not have computers, and one of 55 (2 percent) has computers but no

Internet access.

The main reason cited for not having Internet access by the one respondent without Internet (but with computers) is too expensive.

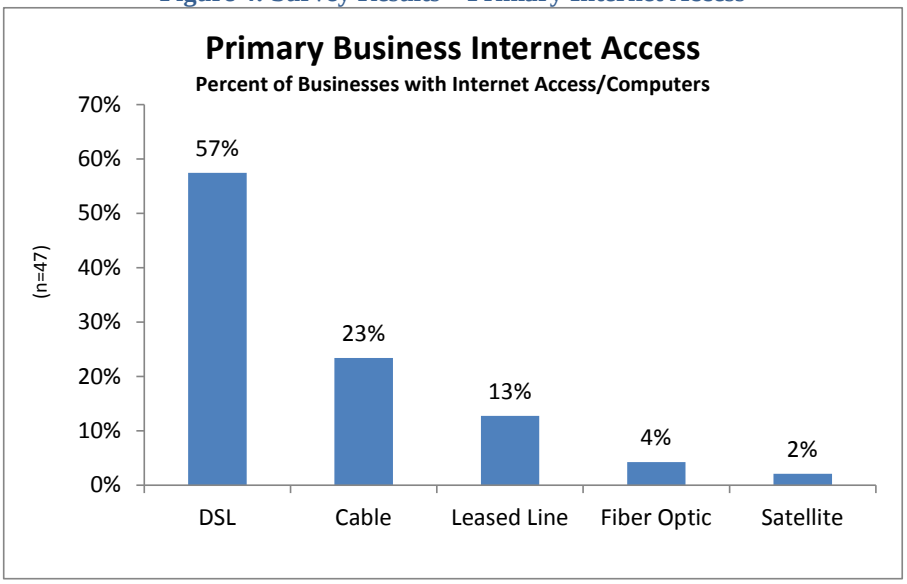
Figure 3: Survey Results – Internet Access at Location



Internet Connection

Among responding business with computers and Internet access, 27 of 47 (57 percent) have DSL. Market share for cable (11 of 47; 23 percent), leased line (six of 47, 13 percent), fiber optic (two of 47, four percent), and satellite (one of 47, two percent) is considerably lower.

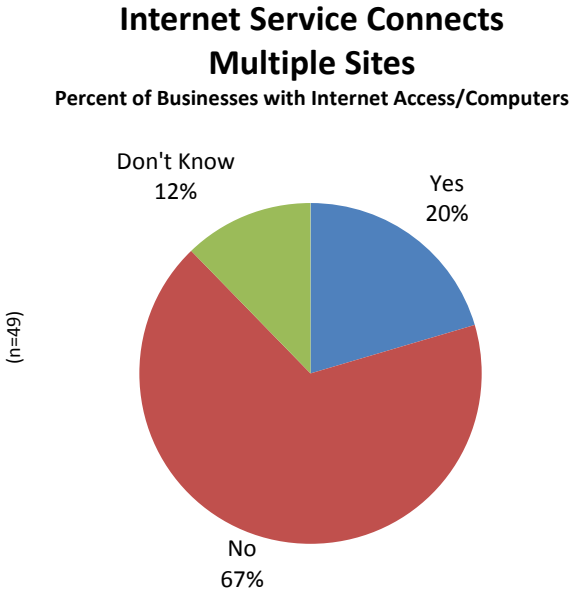
Figure 4: Survey Results – Primary Internet Access



Multiple Sites

Ten of 49 (20 percent) responding businesses with Internet access/ computers said their Internet service connects multiple sites within their city or location. This suggests that a sizeable number of respondents are part of larger businesses networks. Another 33 of 49 (67 percent) said their Internet service does not connect multiple sites, and six of 49 (12 percent) do not know.

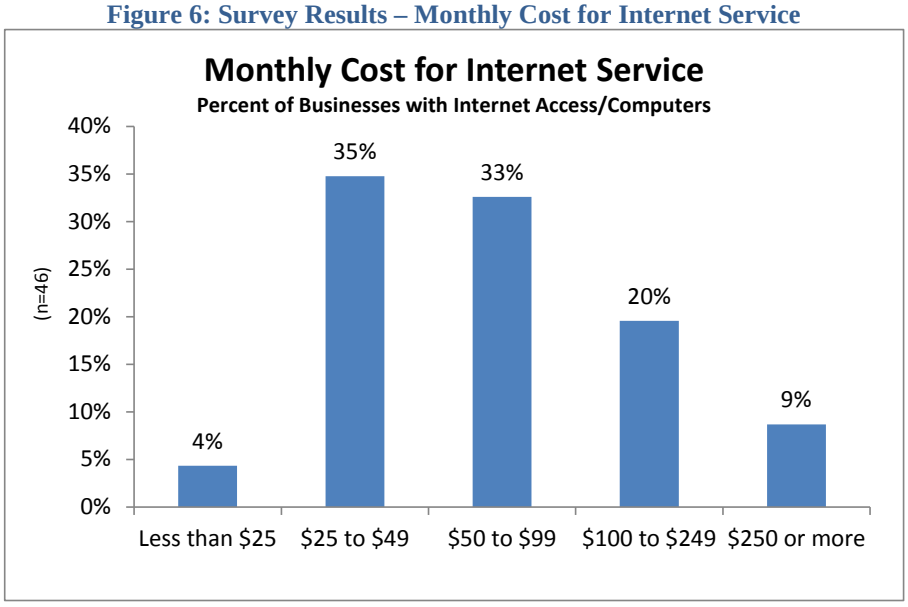
Figure 5: Survey Results – Internet Service Connects Multiple Sites



Monthly Cost

The average subscriber pays an estimated $105 per month for Internet service. Sixteen of 46 (35 percent) pay $25 to $49 per month, and 15 of 46 (32 percent) pay $50 to $99 per month. Another nine (20 percent) pay $100 to $249 per month.

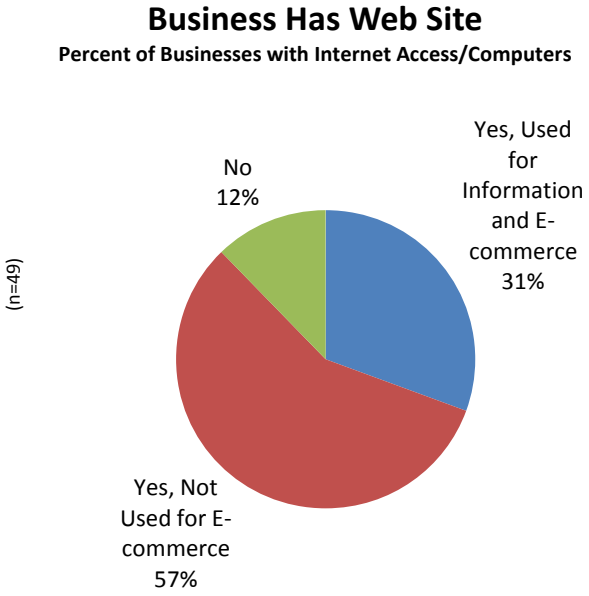
Figure 6: Survey Results – Monthly Cost for Internet Service



Website

Forty-three of 49 (88 percent) responding businesses with Internet access/computers have a website. Fifteen (31 percent) use their website for information and e-commerce (such as selling products), while 28 (57 percent) said it is not used for e-commerce.

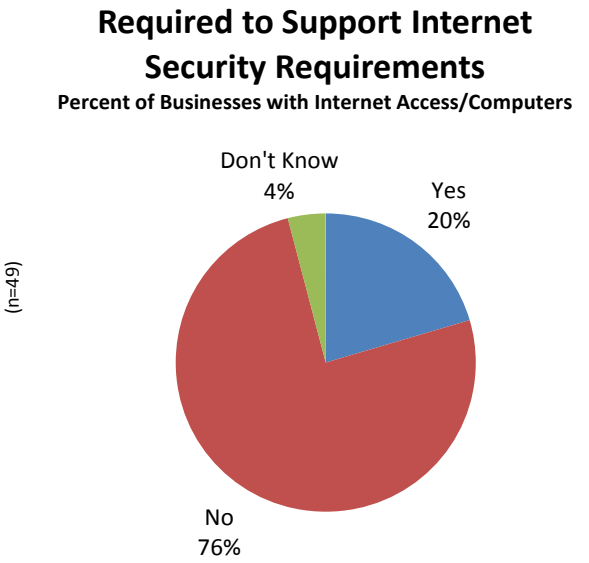
Figure 7: Survey Results – Business Has Website



Internet Security

Ten of 49 (20 percent) with Internet access said they are required to support industry-specific Internet security requirements.

Figure 8: Survey Results – Business Required to Support Internet Security Requirements



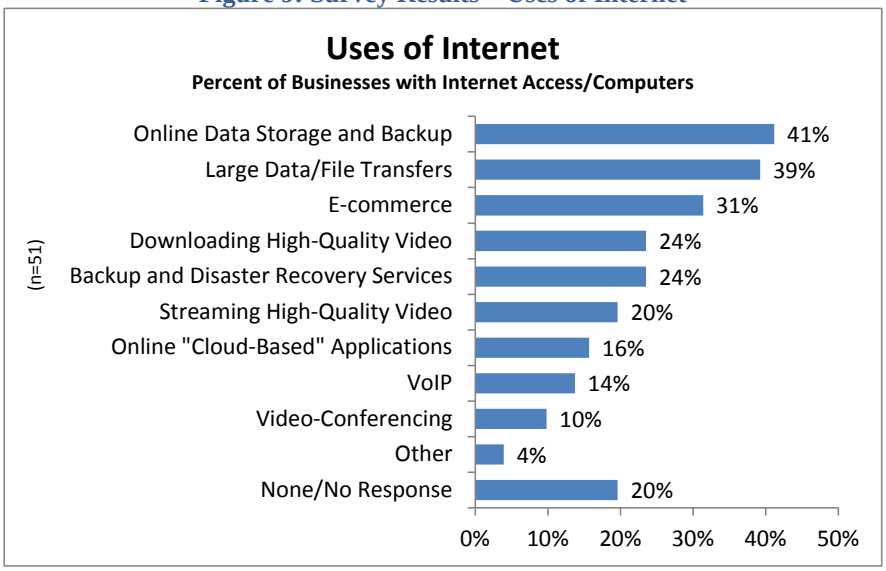
5.3.2 Internet Use and Connectivity

Respondents were asked how their business uses the Internet and to assess the potential impact of connectivity issues. This information provides valuable insight into businesses' need for improved communications services.

Uses of Internet

The top uses of the Internet among the 51 responding businesses with Internet access/computers are: Online data storage and backup (21 of 51, 41 percent) and large data/file transfers (20 of 51, 39 percent).

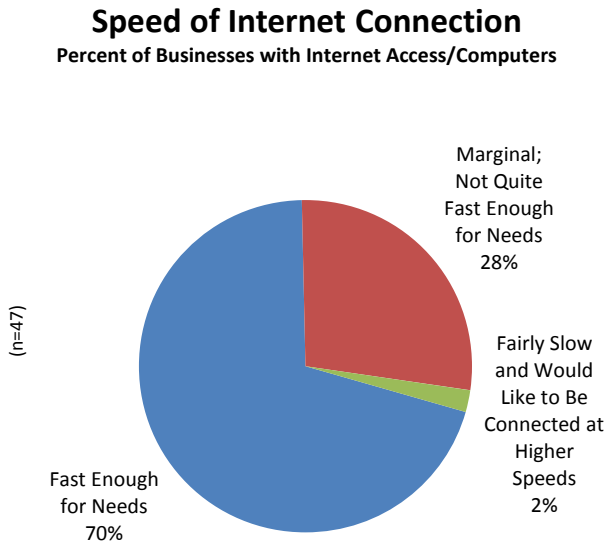
Figure 9: Survey Results – Uses of Internet



Connection Speed

Internet service providers appear to be meeting the needs of respondents in terms of connection speed. Overall, 33 of 47 (70 percent) said their connection is fast enough to meet their needs. Another 13 (28 percent) said their connection speed is marginal.

Figure 10: Survey Results – Speed of Internet Connection



Seriousness of Internet Connectivity Problems

Using a scale where 1=Not at All Serious and 5=Very Serious, respondents were asked to assess the seriousness of potential connectivity problems for their business. Among the issues evaluated, downtime (20 of 49, 41 percent Very Serious; 3.3 mean) and getting prompt service for problems (18 of 49, 37 percent Very Serious; 3.2 mean) are the most serious.

Figure 11: Survey Results – Seriousness of Internet Connectivity Problems (Mean Rating)

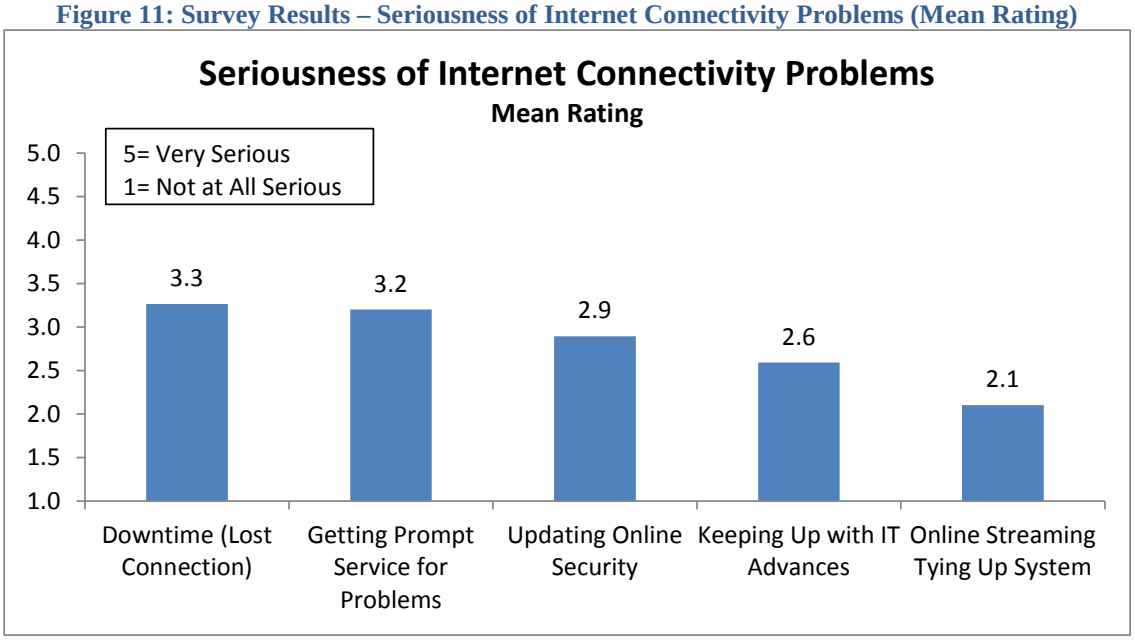
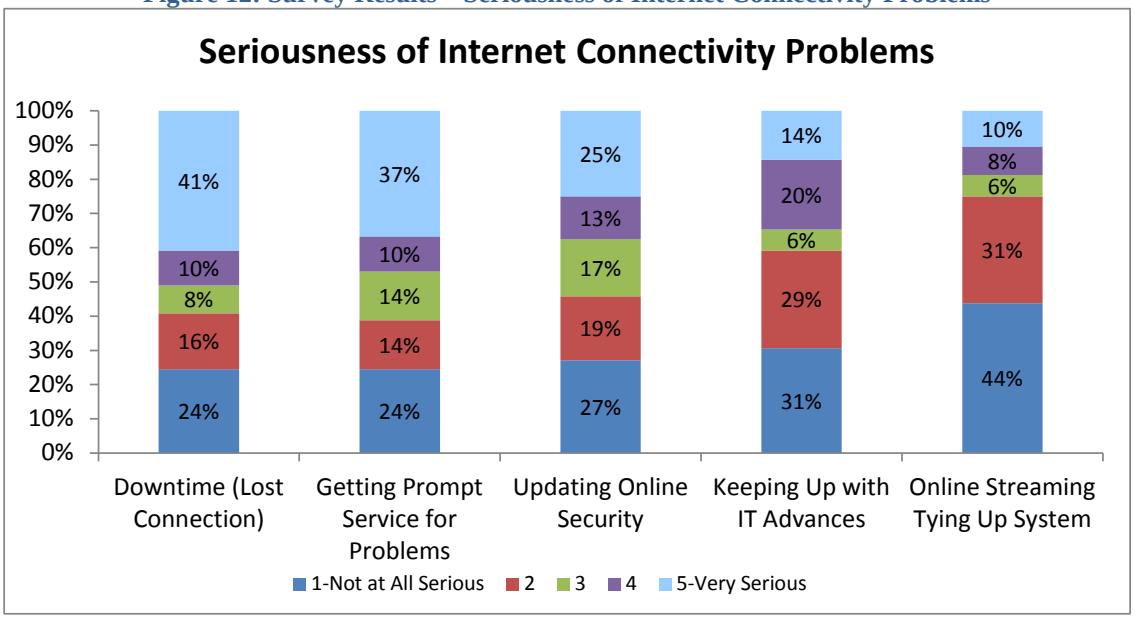


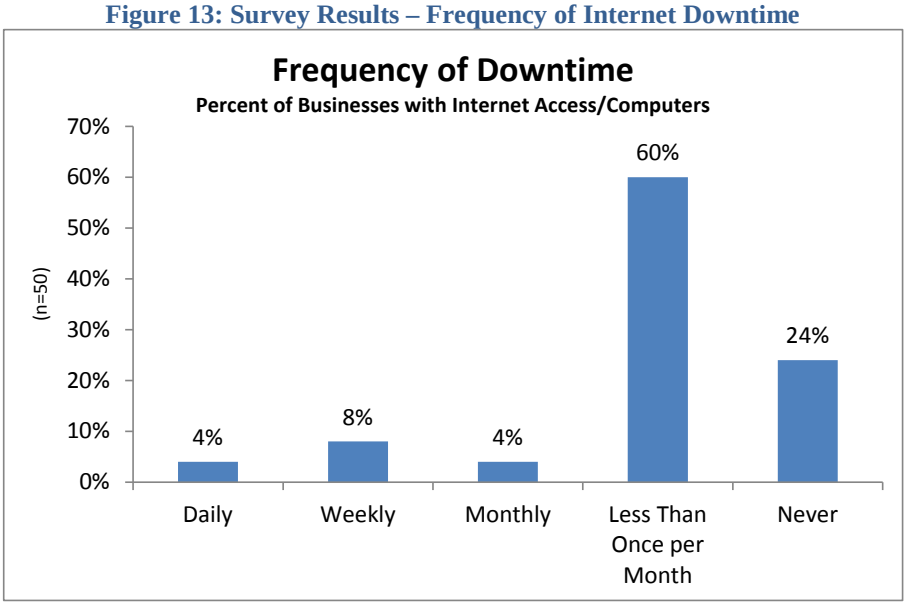
Figure 12: Survey Results – Seriousness of Internet Connectivity Problems



Frequency of Downtime

Most respondents indicated that their business infrequently experiences downtime or lost connection. Thirty of 50 (60 percent) experience downtime less than once per month on average, and another 12 (24 percent) said they never experience downtime. A small segment (eight of 50, 16 percent) experiences downtime at least monthly.

Figure 13: Survey Results – Frequency of Internet Downtime

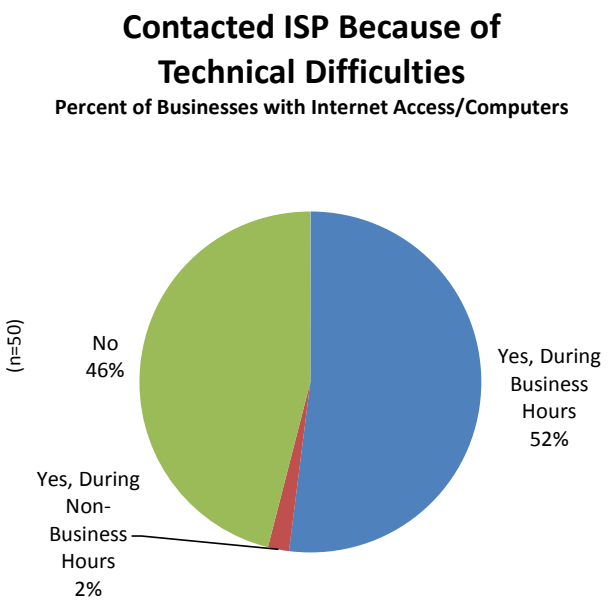


Contact for Connection and Other Problems

The majority (48 of 50; 96 percent) of responding businesses with Internet access/computers

know whom to contact if they were to experience connection problems. In fact, more than one-half (27 of 50, 54 percent) did contact their Internet service provider because of technical difficulties, billing, or other issues.

Figure 14: Survey Results – Businesses Contacted ISP



Twenty-six of the 27 who reported contacting their ISP said they did so during business hours. On average, the timeliness of the ISP's response was good (mean rating of 3.0). Specifically, nine of 26 (35 percent) said it was fair, eight of 26 (31 percent) said it was good, and six of 26 (23 percent) said it was very good. Just one (4 percent) said it was poor, and two (8 percent) said it was excellent.

Most (22 of 26, 85 percent) said their issue was resolved in a satisfactory manner.

5.3.3 Satisfaction with and Importance of Internet Services

Respondents were asked to evaluate the Internet service they receive. This information provides valuable insight into businesses' need for various communications services.

Importance and Satisfaction with Service Aspects

Customers were asked to rate their level of satisfaction (using a scale where 1=Very Dissatisfied and 5=Very Satisfied) with various aspects of their Internet service, along with the importance (using a scale where 1=Not at All Important and 5=Very Important) of those factors.

Figure 15: Survey Results – Importance of/Satisfaction with Internet Service

Importance of and Satisfaction with Internet Service Aspects

		Price paid for service	Download speed	Upload speed	Reliability (uptime)	Provider choice	Customer service
Importance	1-Not at All Important	2%	2%	4%	2%	6%	2%
	2	0%	0%	2%	0%	12%	6%
	3	18%	8%	20%	0%	29%	14%
	4	32%	40%	38%	16%	29%	26%
	5-Very Important	48%	50%	36%	82%	24%	52%
	Mean	*4.2*	*4.4*	*4.0*	*4.8*	*3.5*	*4.2*
Satisfaction	1-Very Dissatisfied	4%	0%	0%	6%	6%	2%
	2	2%	6%	10%	0%	12%	14%
	3	40%	34%	36%	18%	48%	32%
	4	30%	40%	36%	34%	24%	38%
	5-Very Satisfied	24%	20%	18%	42%	10%	14%
	Mean	*3.7*	*3.7*	*3.6*	*4.1*	*3.2*	*3.5*

Overall, the most **important** service aspect is reliability (40 of 49, 82 percent Very Important; 4.8 mean), followed by: Download speed (25 of 50, 50 percent Very Important; 4.4 mean), customer service (26 of 50, 52 percent Very Important; 4.2 mean), price (24 of 50, 48 percent Very Important; 4.2 mean), upload speed (18 of 50, 36 percent Very Important; 4.0 mean) , and provider choice (12 of 49, 24 percent Very Important; 3.5 mean).

Overall, most Internet users appear to be moderately satisfied with aspects of their Internet service, although there is some room for improvement. Aspects receiving the highest **satisfaction** ratings are also those evaluated as more important. Reliability was the highest-rated aspect (21 of 50, 42 percent Very Satisfied; 4.1 mean), followed by download speed (10 of 50, 20 percent Very Satisfied, 3.7 mean), price (12 of 50, 24 percent Very Satisfied; 3.7 mean), upload speed (nine of 50, 18 percent Very Satisfied; 3.6 mean), customer service (seven of 70, 14 percent Very Satisfied; 3.5 mean), and Provider choice (five of 50, 10 percent Very Satisfied; 3.2 mean).

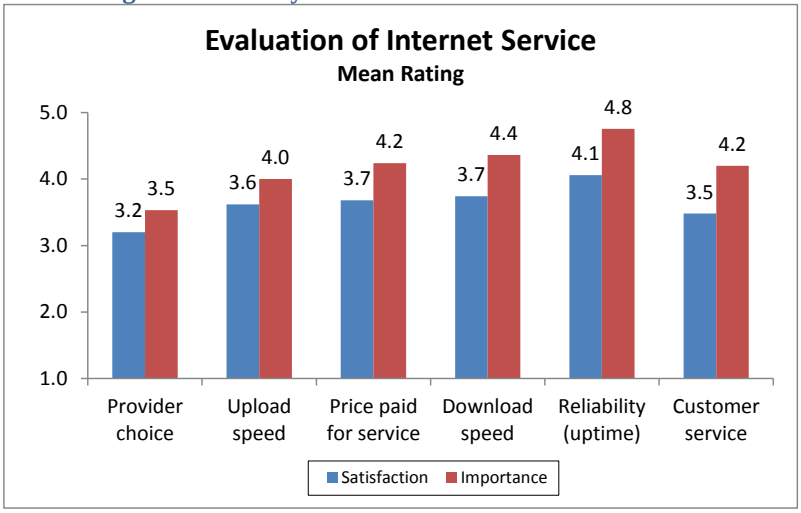
The next charts highlight the **gaps** between **importance** of services provided and **satisfaction** with those aspects. Although most Internet users were relatively satisfied overall, assessing the gaps can help providers identify what features might need improvement.

Figure 16: Survey Results – Gap Between Satisfaction with/Importance of Internet Service

	Satisfaction	Importance	Gap
Provider choice	3.20	3.53	-0.3
Upload speed	3.62	4.00	-0.4
Price paid for service	3.68	4.24	-0.6
Download speed	3.74	4.36	-0.6
Reliability (uptime)	4.06	4.76	-0.7
Customer service	3.48	4.20	-0.7

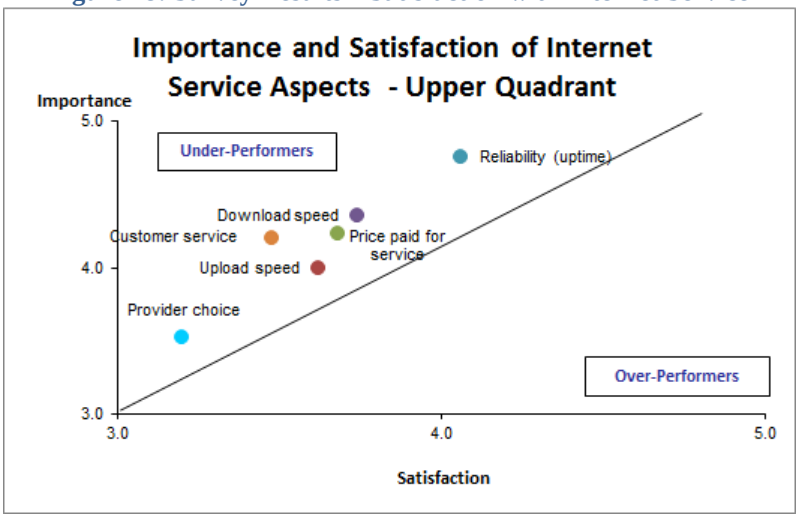
The results suggest that customers are generally satisfied with the most important aspects of service, but there is a sizeable “service gap” (difference between importance and satisfaction) with business Internet service.

Figure 17: Survey Results – Evaluation of Internet Service



The largest gaps occur for customer service and reliability (uptime), followed by download speed and price paid for service. Respondents expressed the least satisfaction with their ability to choose among competing providers, but this aspect is less important compared with other aspects of service.

Figure 18: Survey Results – Satisfaction with Internet Service

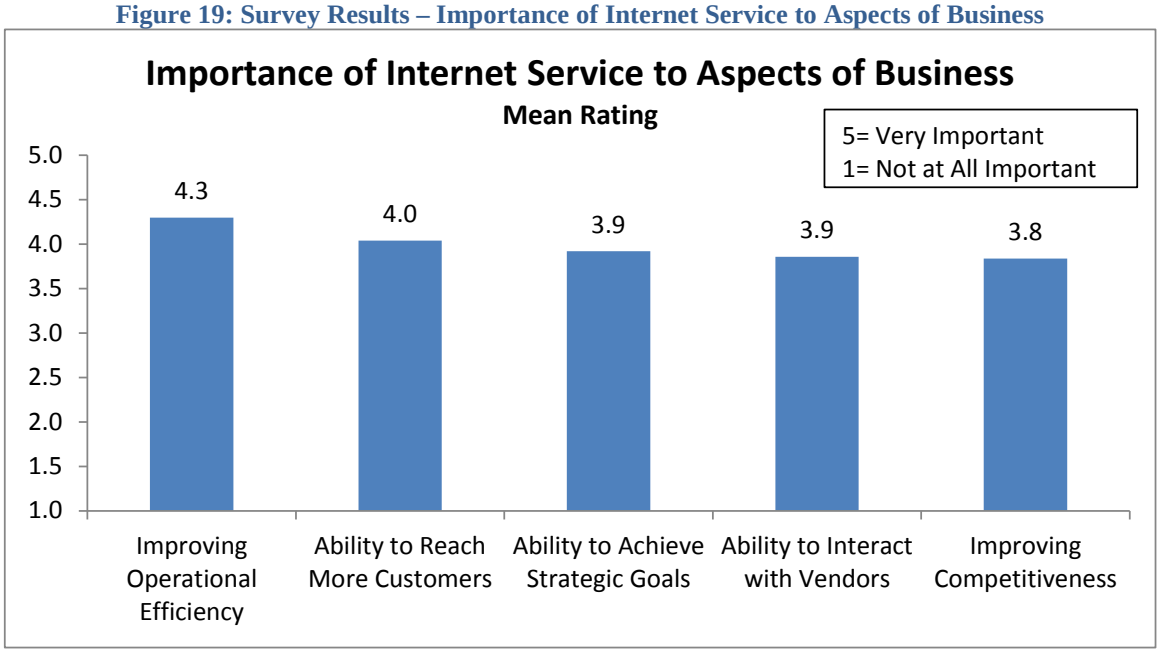


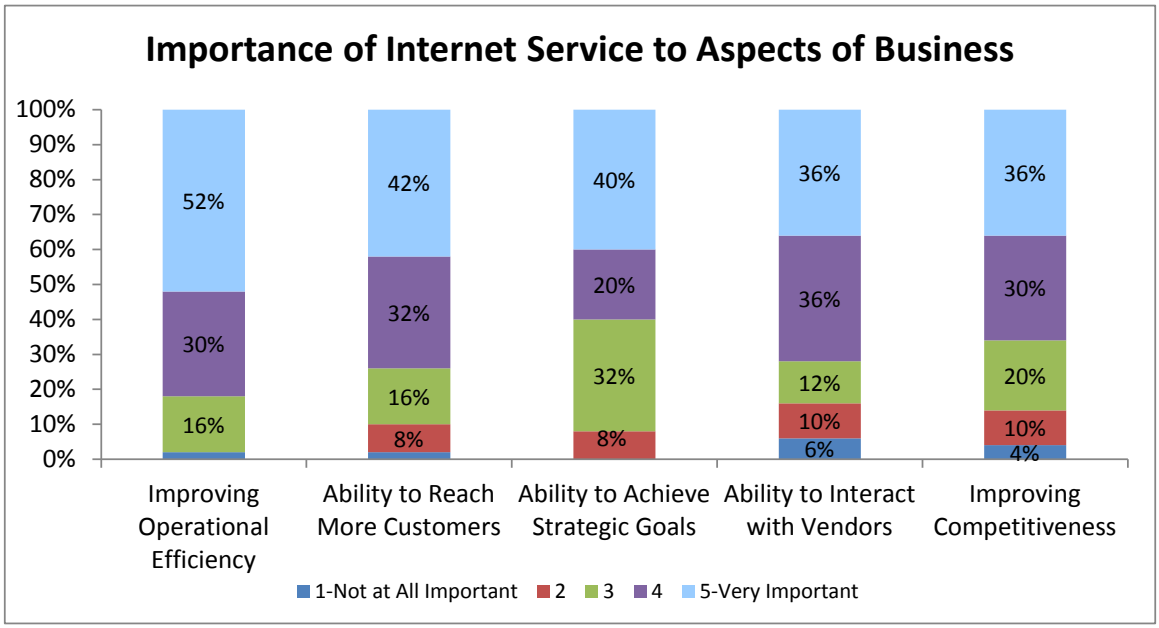
Although respondents are relatively satisfied with their Internet service, all aspects are considered "under-performers" in the regard that satisfaction scores are lower than importance scores.

Importance of Internet Service to Business

Respondents were asked to evaluate the impact of Internet service on aspects of their business, using a scale where 1=Not at All Important and 5=Very Important. Although Internet service appears to be relatively important for all aspects of business evaluated, the most important benefit appears to be Improving operational efficiency (26 of 50, 52 percent Very Important; 4.3 mean).

Figure 19: Survey Results – Importance of Internet Service to Aspects of Business

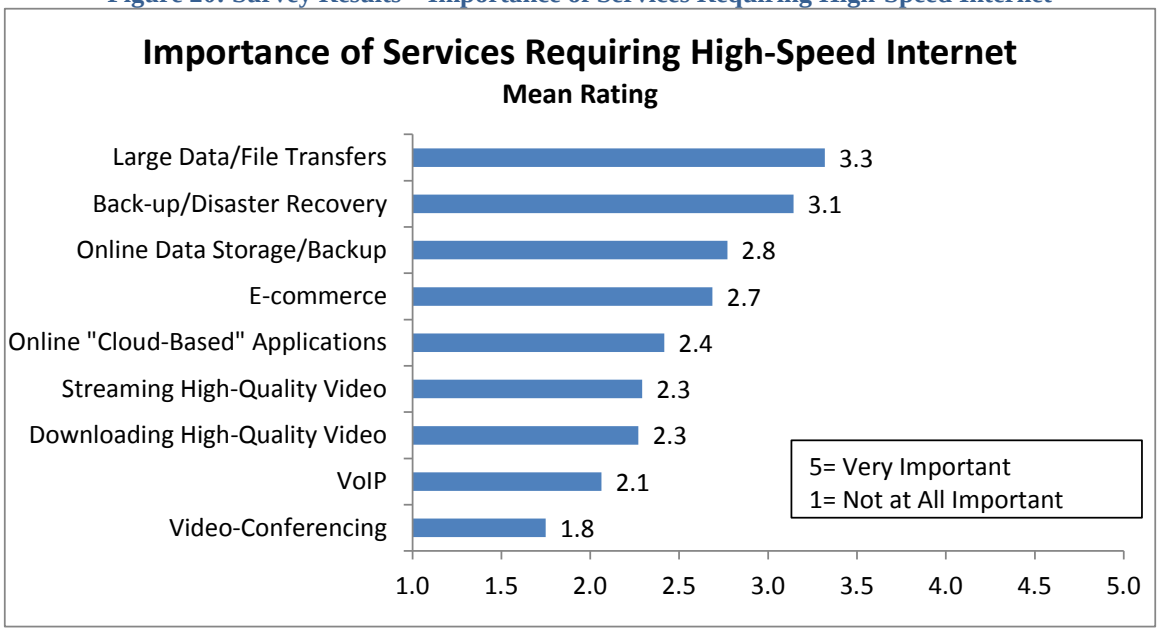


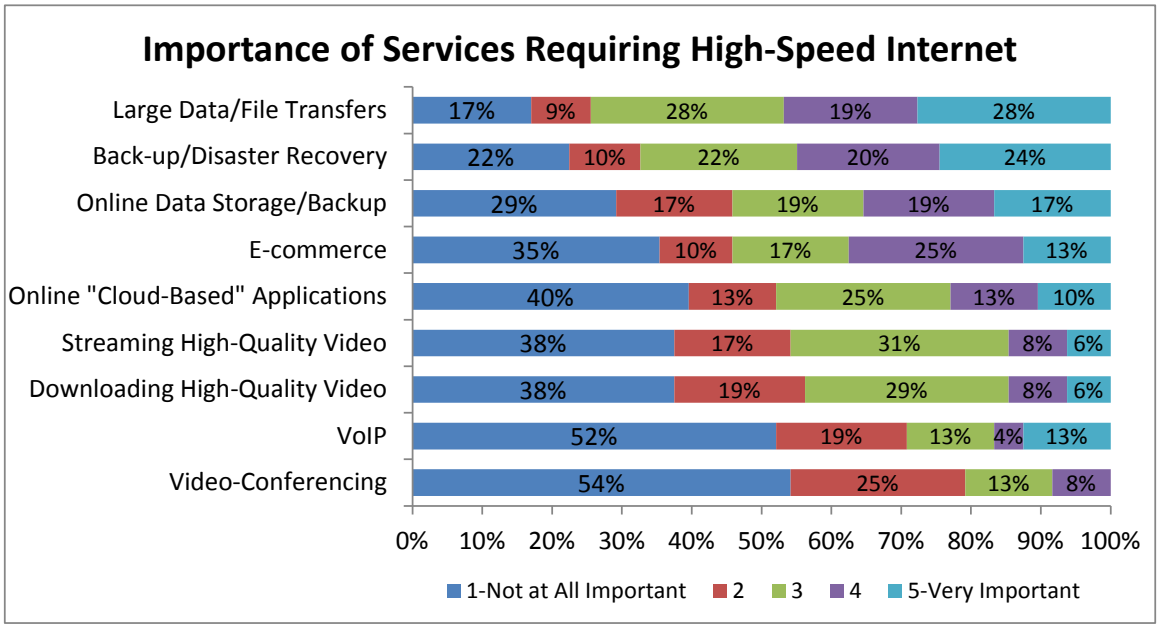


Importance of Internet Services or Activities to Business

Using a scale where 1=Not at All Important and 5=Very Important, respondents were asked to assess the level of importance of various uses of the Internet (requiring high-speed Internet). Overall, the two most important services appear to be: Large data/file transfers (13 of 47, 28 percent Very Important; 3.3 mean) and Back-up/disaster recovery (12 of 49, 24 percent Very Important; 3.1 mean). Online data storage/backup and E-commerce also appear to be relatively important to a segment of respondents, while VoIP and Video-conferencing are not important to the majority of responding businesses.

Figure 20: Survey Results – Importance of Services Requiring High-Speed Internet

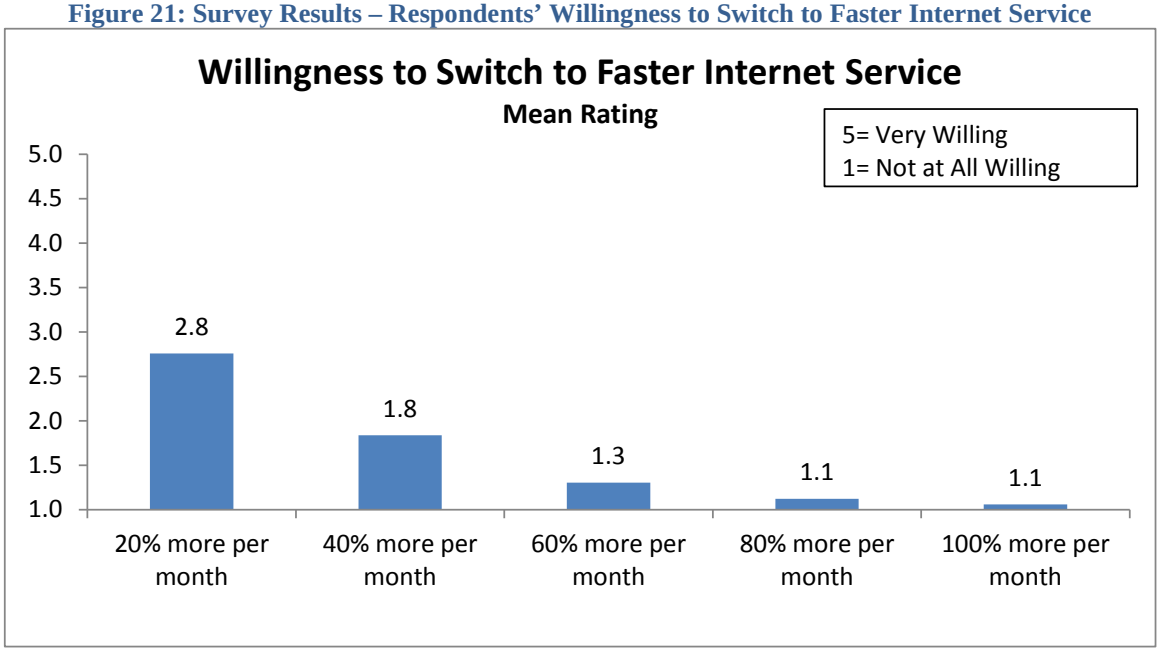


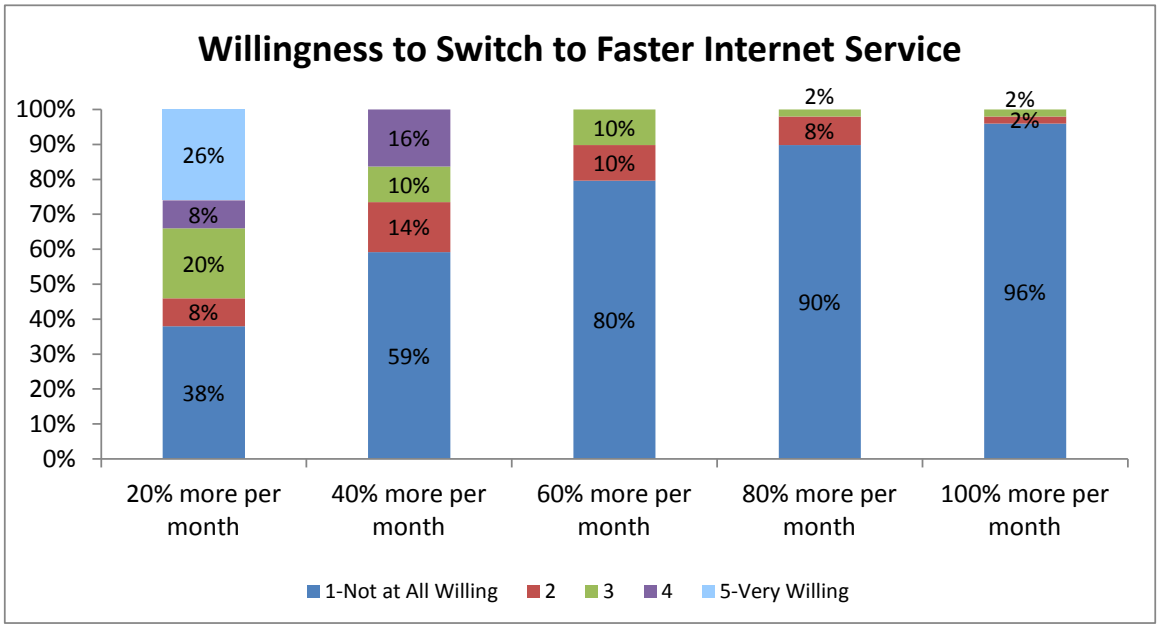


Willingness to Pay More for Faster Internet Access

Respondents were asked how willing they would be to pay more for Internet service that allowed them to more quickly and efficiently perform the activities listed above. The majority of respondents would be unwilling to pay more at the various price increases listed. For even a 20 percent price increase, 23 of 50 (46 percent) respondents would be unwilling to pay more. However, there is a segment (17 of 50, 34 percent) who might consider paying 20 percent more per month if the Internet service improved the performance of key services or activities. This suggests the potential for a relatively small commercial market for high-bandwidth Internet service at a 20 percent price increase.

Figure 21: Survey Results – Respondents' Willingness to Switch to Faster Internet Service





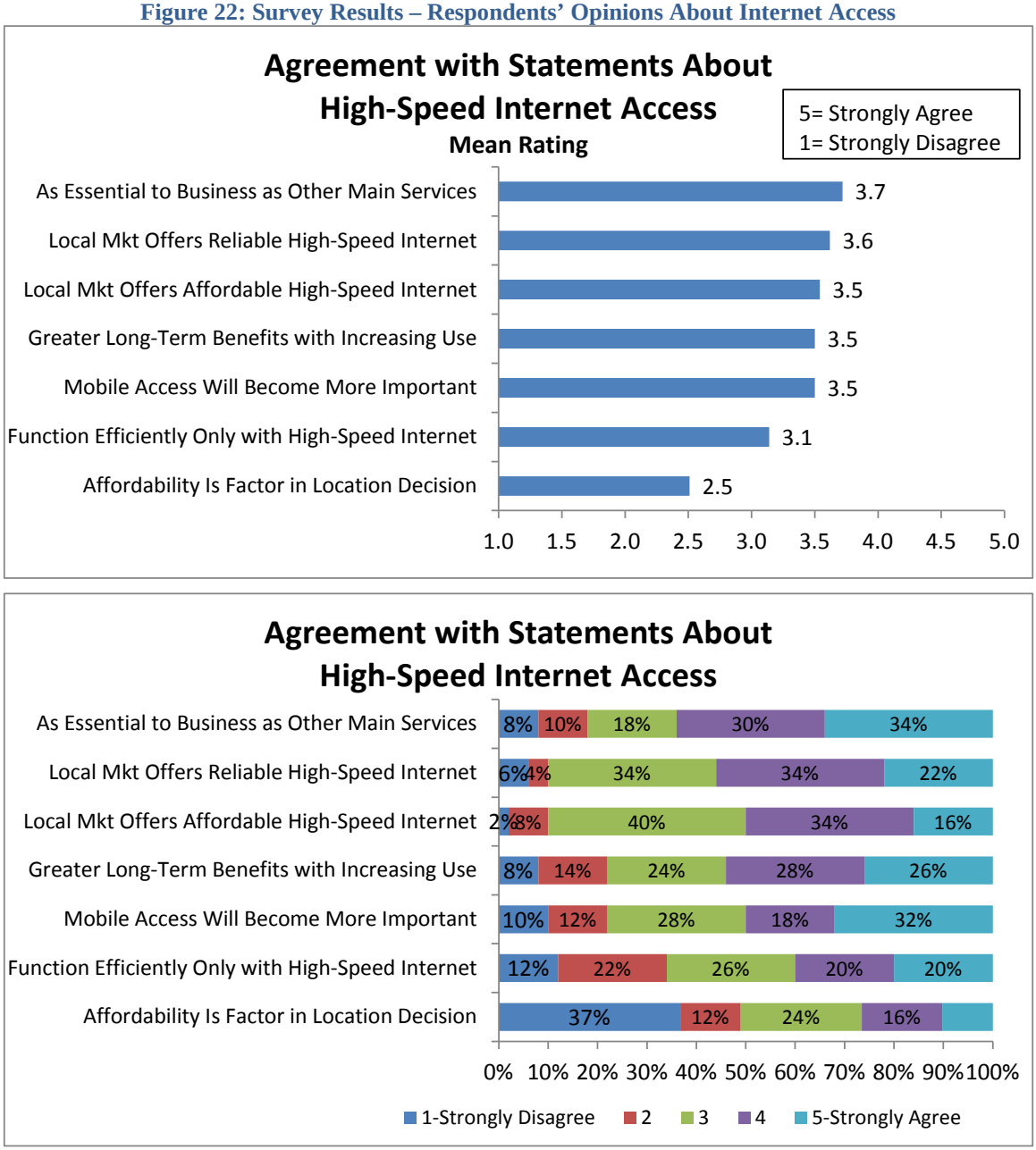
Attitudes About High-Speed Internet Access

Respondents were asked to rate their level of agreement with statements about high-speed Internet access, using a scale where 1=Strongly Disagree and 5=Strongly Agree.

Overall, most respondents agreed with most of the statements listed, including that high-speed Internet is as essential to their business as other main services such as water and sewer or electricity (17 of 50, 34 percent Strongly Agree; 3.7 mean). They were least likely to agree with the statement that the availability of affordable Internet access is a factor in deciding where to

locate their business (18 of 49, 37 percent Strongly Disagree; 2.5 mean). There is considerable variation in responses, suggesting different segments of users who place more or less value on high-speed Internet access.

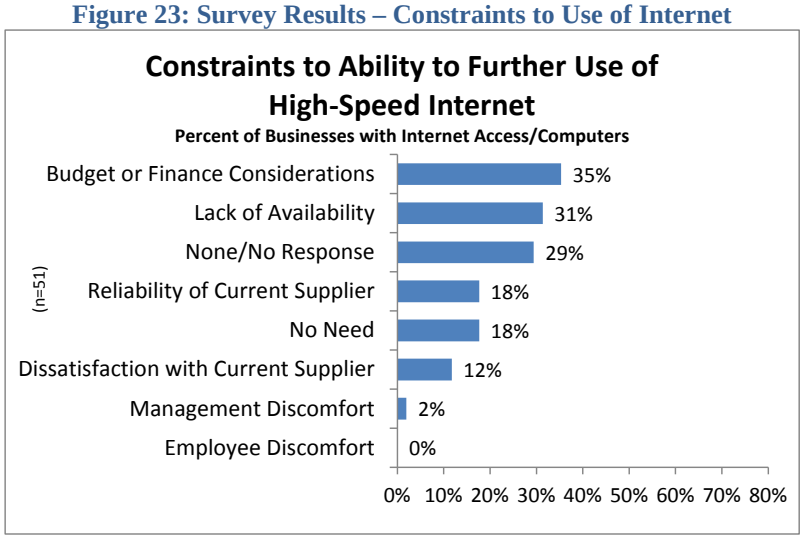
Figure 22: Survey Results – Respondents' Opinions About Internet Access



Constraints to Internet Usage

Among responding businesses with Internet access/computers, the leading constraints to further use of high-speed Internet are: Budget or finance considerations (18 of 51, 35 percent) and lack of availability (16 of 51, 31 percent). Another 15 (29 percent) did not indicate there are any constraints to further usage.

Figure 23: Survey Results – Constraints to Use of Internet

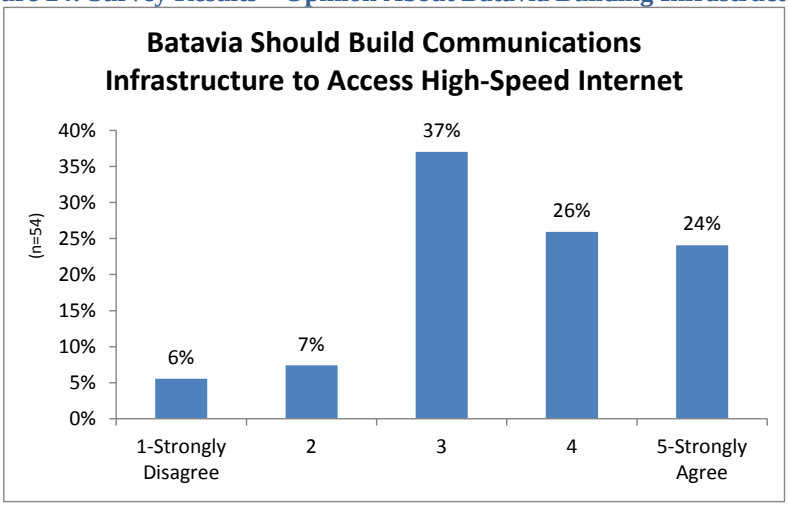


Opinions About City of Batavia

City of Batavia's Role in Facilitating Access

Respondents were asked to rate their level of agreement with the City of Batavia's role in facilitating community access to very high speed Internet service at competitive prices. Overall, respondents agree somewhat that Batavia should build a communications infrastructure to help businesses access high-speed Internet services, giving a mean rating of 3.6 and a median of 3.5 on a scale where 1=Strongly Disagree and 5=Strongly Agree. Thirteen of 54 (24 percent) strongly agree.

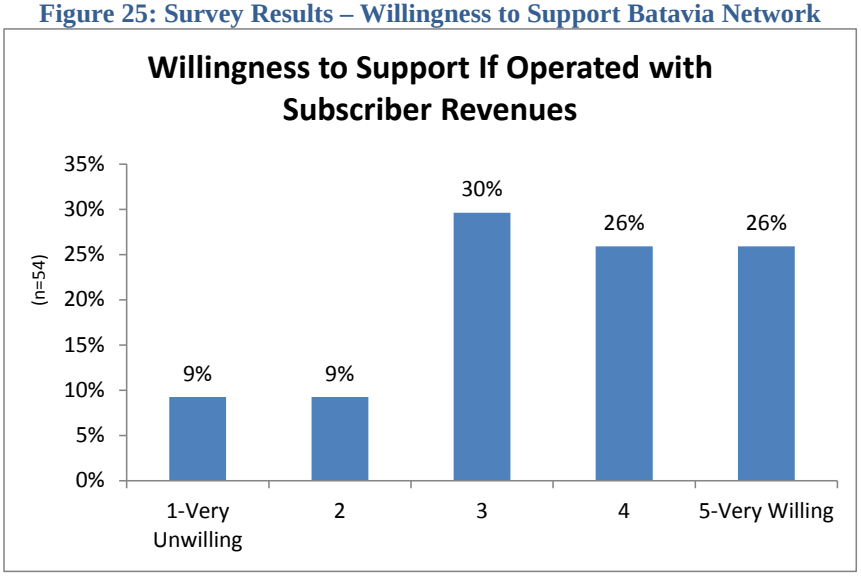
Figure 24: Survey Results – Opinion About Batavia Building Infrastructure



Willingness to Support Communications Network

Respondents were also asked their willingness to support a plan for the City of Batavia to build, own, and operate a communications network for private companies to use. Overall, respondents would be somewhat willing to support this plan if it were supported with subscriber revenues only, giving a mean rating of 3.5 and median of 4.0 on a scale where 1=Very Unwilling and 5=Very Willing. Fourteen of 54 (26 percent) would be very willing to support this plan.

Figure 25: Survey Results – Willingness to Support Batavia Network



Company Information

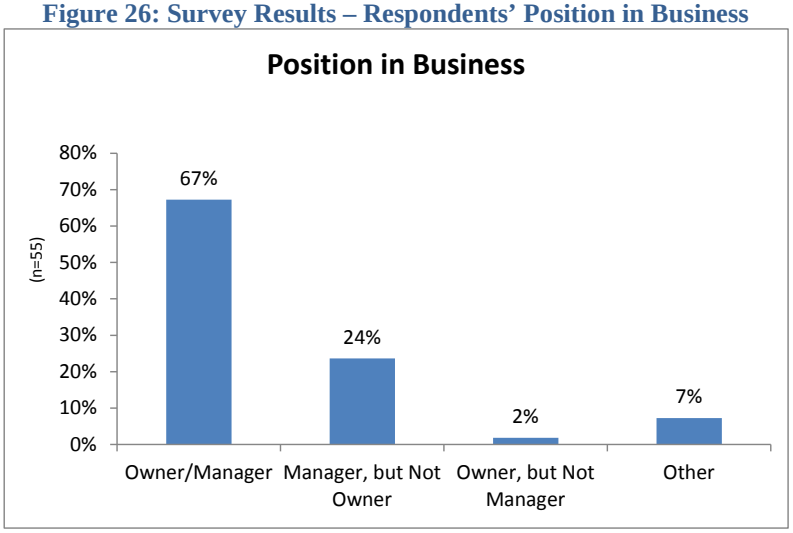
In addition to information about Internet services, the survey asked a number of questions about the characteristics of responding businesses. A general summary of the company information for respondents is provided in this section. The general profile of respondents includes:

- Most are owners/managers.
- Most Internet or phone decisions are made locally.
- The majority are small- to mid-sized locations. Very few have 50 or more employees.
- Businesses represent a variety of industries, including professional services, other services, and manufacturing.

Position

Thirty-seven of 55 (67 percent) respondents are owners/managers, and 13 of 55 (24 percent) are managers but not owners. Just one (2 percent) is an owner but not a manager, and four (7 percent) indicated they hold another position.

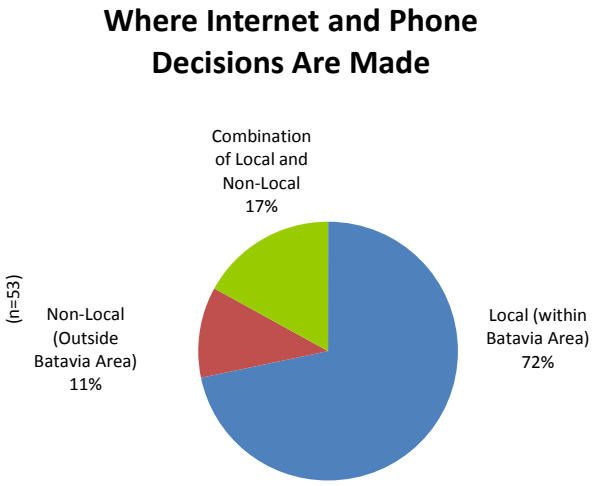
Figure 26: Survey Results – Respondents' Position in Business



Decision Location

Thirty-eight of 53 (72 percent) make Internet and phone decisions locally (within the Batavia area). In contrast, just six (11 percent) make decisions non-locally, and nine (17 percent) said it is a combination of local and non-local.

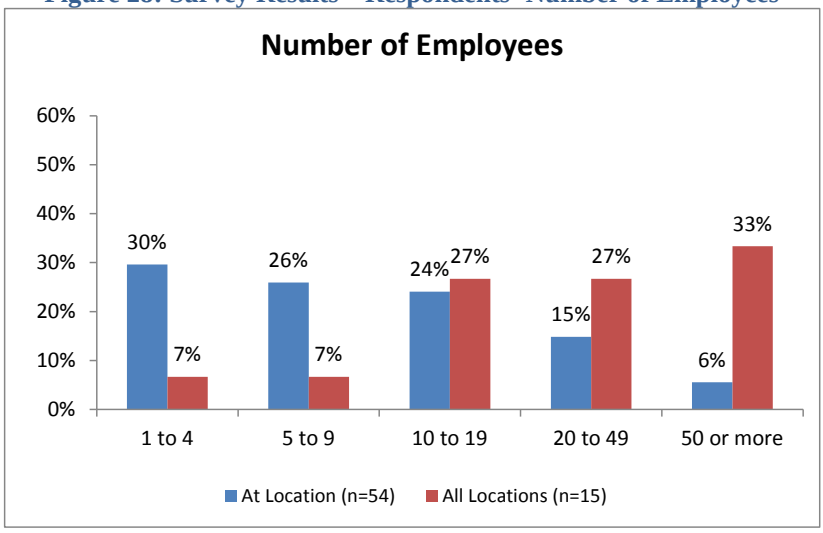
Figure 27: Survey Results – Where Internet Decisions Are Made



Number of Employees

Sixteen of 54 (30 percent) reported one to four employees at the location surveyed, 14 (26 percent) said there are five to nine employees, and 13 (24 percent) reported 10 to 19 employees. Eleven (20 percent) said there are 20 or more employees at that location. It appears that the majority of those with multiple locations said there are at least 10 employees across all locations, but this is based on a very small number of respondents (n=15).

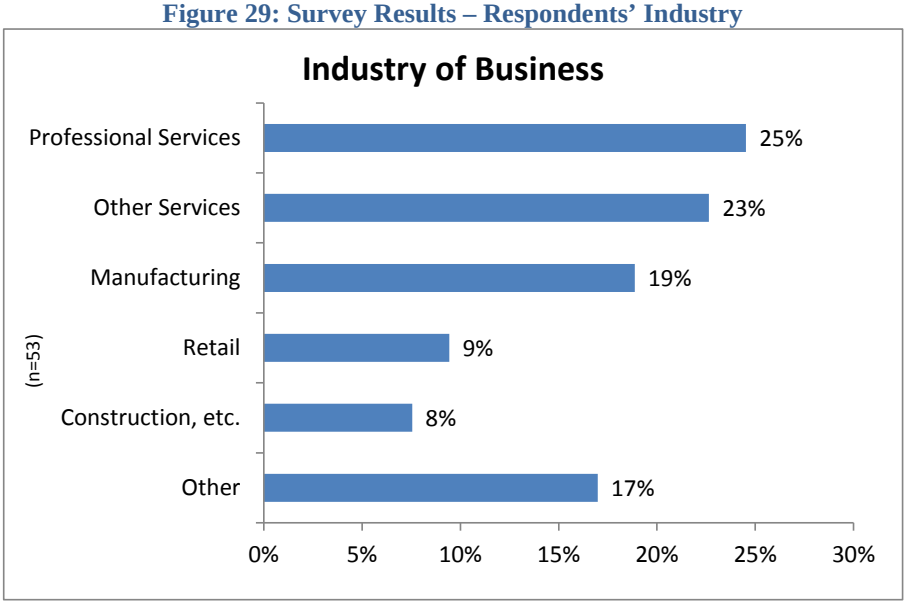
Figure 28: Survey Results – Respondents' Number of Employees



Industry

Businesses included in the survey represent a range of industries. The top industries represented include: Professional services (13 of 53, 25 percent), other services (12 of 53, 23 percent), and manufacturing (10 of 53, 19 percent).

Figure 29: Survey Results – Respondents' Industry



Appendix A: Pilot Project Pro Forma